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A Weekly Journal of the Mining and Mineral Industries

July 2, 1921

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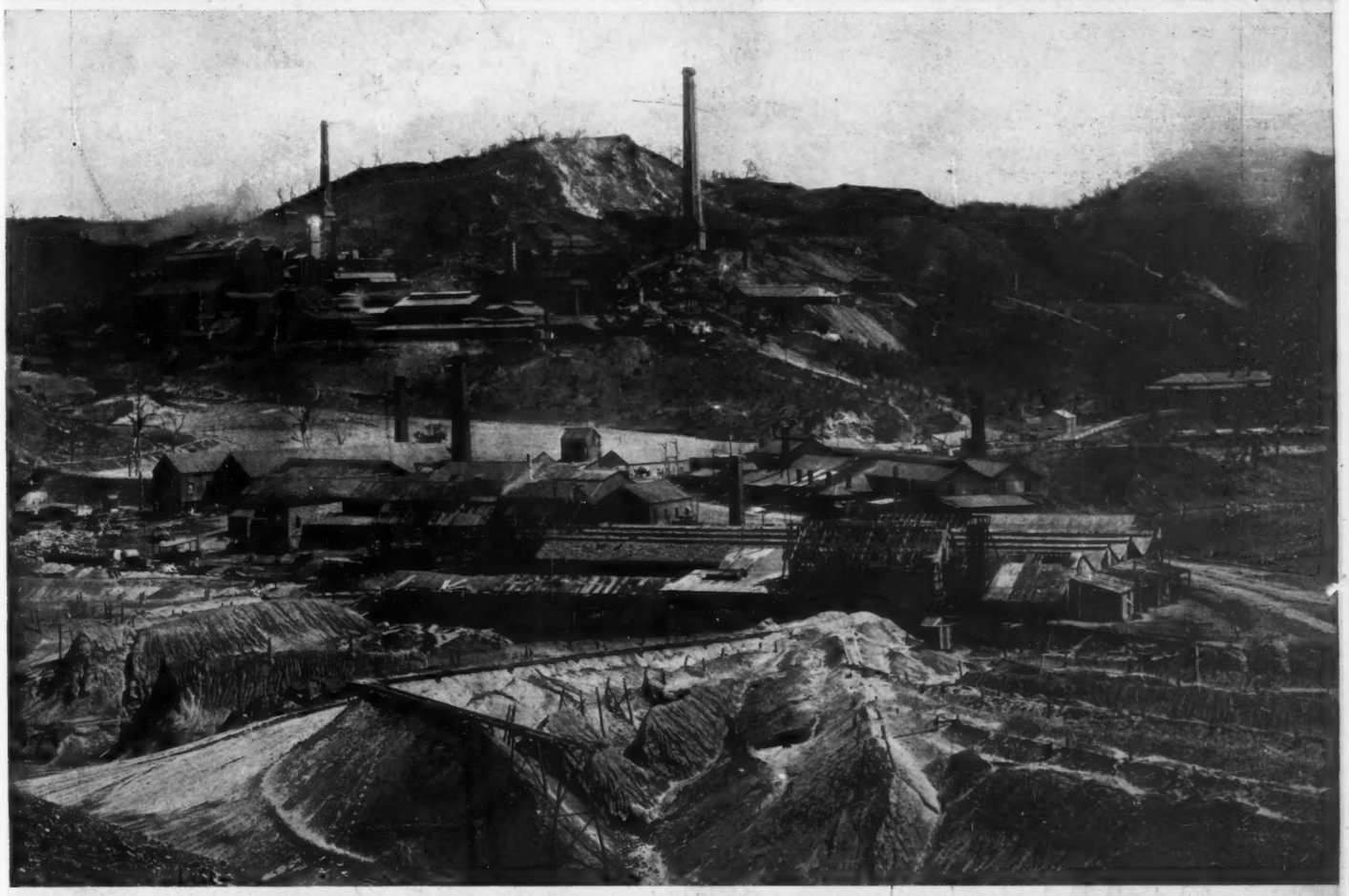


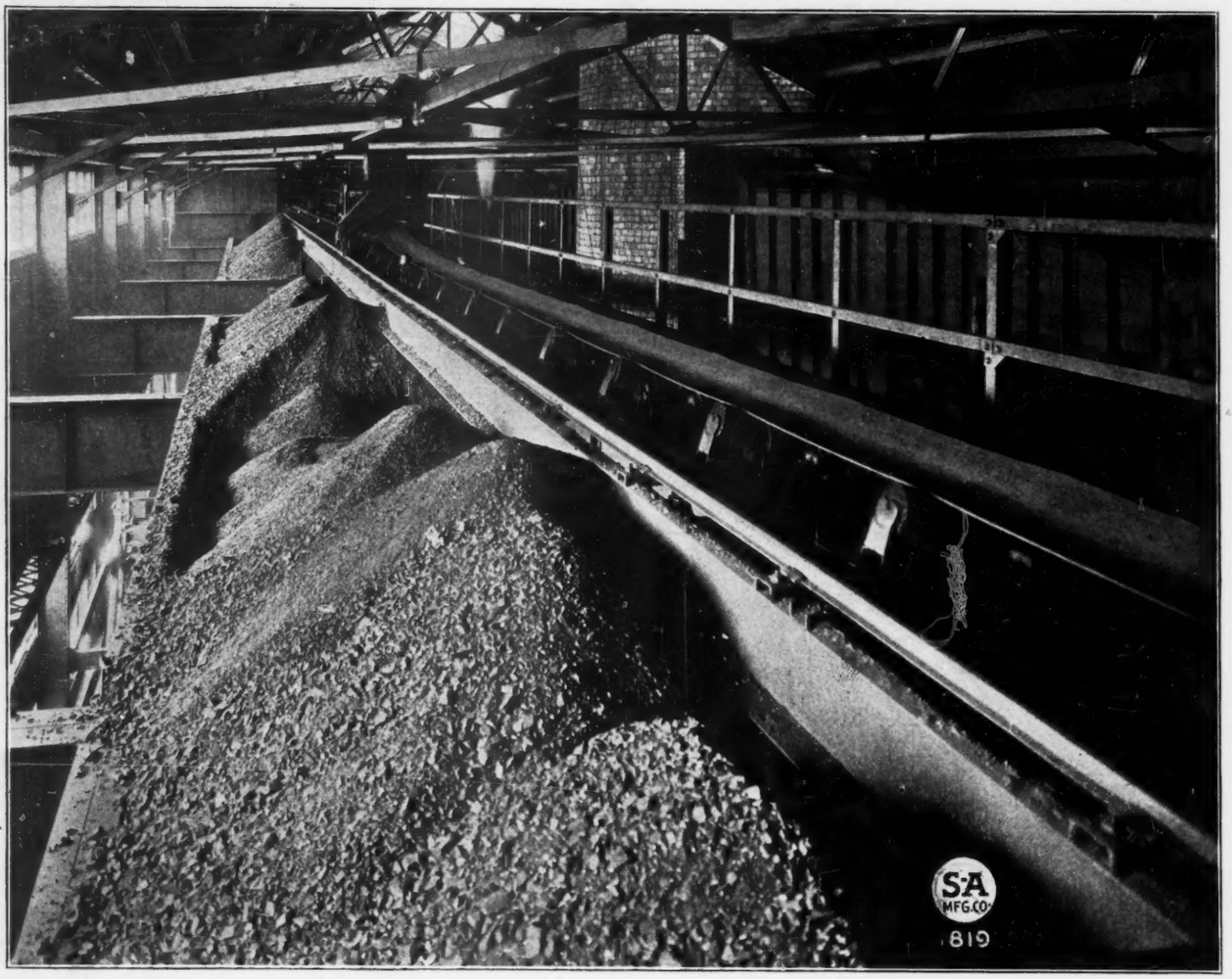
The Mount Morgan Gold-Copper Mine in Queensland
One of the Largest Mines in Australia

Salt Mining in Louisiana

By A. G. Wolf

Churn Drilling of Disseminated Copper Deposits

By E. R. Rice



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A Weekly Journal of the Mining and Mineral Industries
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Volume 112 New York, July 2, 1921 *Number* 1

A World Mineral Policy Platform?

THE FRENCH DELEGATION to the Economic Commission of the Peace Conference passed the following resolution, which was again passed by the Raw Materials Committee of the International Chamber of Commerce on March 14, 1921:

"In order to diminish as much as possible rivalries between peoples in their search for raw materials and to suppress the numerous causes of economic conflicts which endanger the peace of the world, and to neutralize the natural inequalities resulting from the geological distribution of the riches of the world, the Allied Countries and Associates declare that henceforth raw materials destined for industry should be entirely free of duty both as to ingress and egress." . . . "Each of the Allied Countries and Associates reserves the right to regulate by interior rules the exploitation of its natural resources with a view to avoiding too rapid depletion."

It has been pointed out, of course, that this is a policy which would especially inure to the benefit of France, which is poor in natural resources of raw materials; and that it would be a disadvantage to those countries which have important sources of wealth in supplying such raw materials to the world. The point of view has been taken that a country like the Republic of Georgia (formerly in Russia), whose chief wealth is in her manganese deposits, should not be deprived of the right to levy an export tax and derive its chief resources therefrom.

The United States is not, like France, worrying over supplies of raw materials in general; but it is worrying about its future petroleum supplies, and has been working diplomatically on the theory of the international open door for the development of the petroleum resources of the world.

We do not know if any international raw material platform is possible. But in discussing the matter we should like to separate raw materials into two classes —those which form an eternal resource, which may be replenished annually, like the wool of Australia, the cotton of our own South, and the rubber of Asia; and those for which Nature has decreed there should be but one crop for all mankind. In this latter class—constituting indeed, practically the whole latter class—stand our mineral resources.

First, may we support the principle that there shall be in the world neither import nor export duties on minerals? It is true that Nature put these treasures where she chose, and that the chance inhabitants of the lands where they occur have not put them there, nor are they maintained by their industry or ingenuity. No careless uncivilized population can injure the mineral resources of a land; no population so thrifty and hardworking that they can produce their ores, if they live in a land where they are not indigenous. Is it, then, true that the inhabitants have always a right to sit down on their mineral stores and levy tribute on the industrial world which comes to seek them? Is it true that the semi-civilized tribes of Georgia have the right to tax the steel industry of Europe and America for their manganese, in order that they may flourish without effort? They cannot use the ore themselves.

Coming nearer home, is it fair that Mexico should levy an increasing export tax on her petroleum, needed chiefly for American and British industries? Is it fair that the villagers of Upper Silesia should cast their stupid votes to determine whether the coal and zinc which lie under their feet should save the industries of Germany, or should shape the destinies of Poland?

Mr. Mathewson on European Conditions

E. P. MATHEWSON, on his return from a visit of several weeks to England, France, and Belgium, but chiefly to England, has much of interest to tell regarding the state of affairs in Europe. A return to normal conditions, he thinks, is slowly coming; sentiment and charity are not being considered in the rearrangement, which is following along strictly commercial lines; and Bolshevism is everywhere dying or dead, heed being taken of the horrible example of the practical application of the theories afforded by Russia. The people are continuing, though in a less degree, war-time economies and privations. In Germany particularly is this true, where sugar is still kept in the safe and white bread is rarely seen. War gardens are everywhere maintained, and agricultural activity in all countries is marked. The signs of the trenches are almost eliminated, except on barren hillsides, by the cultivation of the farms. America cannot expect, thinks Mr. Mathewson, to find the customary market in Europe for our surplus food supply.

Asked as to the feeling toward America and Americans, Mr. Mathewson said he found it one of tolerance rather than enthusiastic friendliness. In France, there is a feeling that Americans have profited vastly by the war, have almost all the money in the world, and that French prosperity depends on getting part of it away from them. No doubt many Frenchmen would be surprised to know that the average American seems to be no better off than before the war; in fact, many are not living so comfortably. We have the gold in this country, but it is in the vaults of the financial interests, and not in the pockets of the people. In Brussels, an extravaganza was running at the Alhambra Palace, something on the order of that given at the Hippodrome here in New York. In one number the costumes and flags of the leading nations of the world were exhibited, each being acclaimed by the audience with varying degrees of approval as expressed by applause. The American characterization, however, was received in solemn silence. This, in a country which

has received more kindly aid from America than any other, surprised Mr. Mathewson considerably.

Living costs in the continental countries are generally less than here. In the best Parisian hotels a dinner with wine can be obtained for the same price as a dry dinner in New York. Champagne is two dollars a bottle. If inclined to live simply, one can get good food at very reasonable prices. Often, however, a special price is asked of Americans, and of such, a general desire is manifested to demand all the traffic will bear. Americans can, of course, easily be spotted by their speech, carriage, clothing, and shoes.

England, as we know, has been in the throes of a serious coal strike, which has disrupted many industrial activities. That this had to come is the general opinion, and it is better to have it fought out during a time of comparative business stagnation, as at present. The coal miners had become inefficient, thousands more men being necessary to mine much less coal than before the war, which raised costs so that England could not compete with American coal. This condition could not continue without seriously affecting England's commercial standing. The coal miners, however, Mr. Mathewson thinks, have a real grievance in the abominable conditions under which they live and work. The strike will result, no doubt, in a higher efficiency of labor and better conditions for the workmen. It is likely soon to end, for funds are low; many miners are already back at work in certain districts.

Shipbuilding seems to be in a fair state of activity, despite the seeming surplus tonnage afloat in American ports. Mr. Mathewson went through one large shipyard, where he saw many vessels of various special types on the ways.

In France, the devastated towns and villages are being rebuilt with more regard for sanitary conditions. Formerly they were generally situated on low wet land along the streams, but now the higher hillsides are being utilized. Concrete is being generally used, and the buildings are surmounted by red-tile roofs. On completion, they are turned over by the government to former property holders who were victims of the war. The claims are adjusted something as an insurance claim for a fire loss would be handled in this country.

Germany was anxious to find out just what was to be demanded of her, and now that this has been for the most part decided, is likely to work hard to regain her former commercial position. She is, however, suffering from a dearth of raw material on which to work. The exchange rate is not a cause for worry, Germans desiring to keep it down so that their products will better be able to compete in the world's markets.

The Mines Inspection Act in Illinois

IN 1906 the American Mining Congress in session at Denver, Col., appointed a committee consisting of W. R. Ingalls, James Douglas, J. R. Finlay, J. Parke Channing, and John Hays Hammond to draft a model law covering "Rules and Regulations for Metal Mines." In 1909 this same committee was invited to act as a committee of the American Institute of Mining Engineers and the Mining and Metallurgical Society of America, and in 1911 as a committee of the U. S. Bureau of Mines. For the purpose of securing general discussion and criticism, preliminary drafts of a "Model Law," prepared by this committee, were published in *Engineering and Mining Journal* in 1909 and again in 1910. After about eight years of careful research and study, the final draft of the model law, as recommended, was published by the U. S. Bureau of Mines in 1915 in Bulletin 75.

It is interesting to learn that this law has just passed both houses of the Illinois Legislature. If the law is approved by Governor Small, of which there seems to be no doubt, the measure will be adopted in about the same form that was recommended by the committee and societies above mentioned. Some of the administrative features in the first sections of the draft were changed to make the law suitable to the existing statutes in Illinois creating its Bureau of Mines and in other particulars. A few unimportant changes were made in the rules and regulations on account of local conditions. This procedure follows the example set by other states which have already made use of the model law as a basis for their legislation, making exceptions, of course, to cover local conditions.

This bill, we understand, was introduced at the suggestion of the fluorspar operators of southern Illinois, and credit for its passage is principally due to Mr. James A. Watson, of Elizabethtown, Representative in the Legislature from the section of southern Illinois which embraces the fluorspar mining district. From our observations of the manner in which fluorspar mining is conducted in that section we have every reason to believe that the operators' advocacy of such a bill was not the result of snap judgment. Their opinions were reached after a careful consideration of their local problems, which include a sufficient diversity to warrant agreement or exception to the original reading of the bill. But no exceptions were taken save those made necessary by local conditions, so that again the stamp of approval is placed on the work of the original committee.

War Minerals Relief Anticlimax

TO CARRY OUT the provisions of the War Minerals Relief Act, Franklin K. Lane, Secretary of the Interior, appointed a tribunal composed of a former United States Senator and Governor of a great mining state, a former Chairman of the Mines Committee of the House of Representatives, and a former President of the American Institute of Mining and Metallurgical Engineers. On account of the untimely death of the second member of the commission, his place was taken by a prominent mining engineer of Arizona. The members of this tribunal worked hard and conscientiously, and no one has breathed any criticism of their honesty and fair intentions (although, of course, there are inevitably many personal views concerning their decisions, on the part of those interested). They have completed their work, and tendered their resignations, leaving of the eight million dollars outside limit appropriated by Congress, four and a half million to be turned back into the Treasury. Will Secretary Fall return four and a half million dollars to the Treasury? Will Japan return Shantung? At the present writing no yearnings in that direction are visible.

For a moment forget your own opinion concerning War Minerals Relief matters. We all of us have a tendency to "know better." We can run the Government better than the President. You could run the *Engineering and Mining Journal* better than we can. Up to a certain point, it is a healthy quality in us. But we must admit that in the long run the Supreme Court

has a better chance to make the best decisions than we have, reading in our morning papers, and expounding thereafter: and that the Cabinet knows better how to handle the foreign situation than you do or we do. Looking at it this way, we must acknowledge that Franklin K. Lane constituted such an administrative machine or tribunal for the War Minerals Relief that we can trust, support, and abide by the decisions.

Secretary Lane's successor, Judge Payne, approved of the tribunal and its personnel, and strongly supported it. What does Secretary Fall do? Most of the cases before the commission had been settled, both by the commission and by the Secretary of the Interior: awards had been paid, and the rejected claimants advised by the Attorney General that they had been ruled out by the act of Congress. But there were a hundred claims or so left over for Secretary Fall's ratification of the commission's decision. These he did not ratify. He accepted the resignation of "Honest John" Shafroth, Ex-Governor and Senator for Colorado; of Phil. Moore, whose sometimes truculent honesty is his outstanding characteristic, and of the conscientious and judicial Pomeroy. And then? He appointed, in their place, one West Virginia lawyer, who had been counsel for one of the claimants, and who, somewhat singularly, hails from the town of Grafton.

But we are not superstitious. Further, Secretary Fall announced that he wanted to see whether the existing act could not be construed in a more liberal way, before Congress should be called upon to amend its provision so as to include those who have been ruled out. Evidently he knows that this can be done: in one case, for example, where the commission recommended the disallowance of a claim, the Secretary disregarded the recommendation and allowed $50,000. No, dear reader, it was not to a poor chrome miner of California; it was to a company of wealthy men from elsewhere; so do not be sentimental.

The commission which has terminated its work was restricted by the act of Congress, but within its powers and within the limits of the consciences of its members as public servants they could not be criticised as not liberal. We could cite a case of a Southern financier, engaged on a mining plan to make war profits, who formed his plan and drove it ahead before the Government asked for greater production. The Government never stimulated him; on the contrary, it was he that pestered the Government. It was agreed by all members of the commission that this financier had not changed his earlier plans in any way through later Government stimulation; yet they liberally handed him $60,000.

We remember another case where, after the combined talent of the corps of engineers, auditors, and the commission had figured out a just award to a claimant, the Secretary (not Secretary Fall), rising above mere figures, ordered an extra $50,000 added on general principles of liberality, and a $2,700 man was instructed to figure out to what parts of the claim it could best be distributed. Certainly, the impartial critic would say that these practices went further in liberality than if the dispensers had to do with their own money or that of their family friends. But their attitude is apparently niggardly when compared to the liberality that is contemplated by Secretary Fall and Judge Robinson of Grafton.

We should like to submit the proposition that if the taxpayers' money is loosely spent by public officials, it is all one to the taxpayer whether it goes into the public officials' pockets or is paid out to their friends or those to whose political and moral support they cater. Also, that the change from the tribunal that has resigned, to the one-man lawyer administration, is in the nature of an anticlimax, and a renegation of impartial government. Give Congress every chance that its members wish to change the provisions of the War Minerals Relief Act. Certainly they botched it the first time: let them try to see if they can mend it. But the executive branch of the Government should honestly and impartially and fearlessly perform its duty, which is simply to administer and carry out the mandates which Congress has laid upon it.

The Right and Wrong of Churn Drilling

IN LAST WEEK'S ISSUE we published the first installment of a most complete treatise on the subject of churn drilling, the second and last installment of which appears in this issue. The importance of this subject in its relation to the subsequent development of any mine cannot be too strongly emphasized, and its particular value is dependent largely on the amount of information on various operations that can be obtained. We feel that the presentation of the topic has been handled in a most able manner by Mr. Rice in his article, "Churn Drilling of Disseminated Copper Deposits," for he has not only considered the technical aspect of churn drilling, but has given us the benefit of his practical work as well, and a careful reading will reveal many points essential to the performance of such work that will be of value to those contemplating similar exploration, or, for that matter, those who are now pursuing drilling operations.

We have seen so many instances where drill work has been improperly done. In the first place, the drilling was done on contract; footage was regarded as the essential thing because it was on that basis that the contractor received his remuneration. Careful sampling was entirely foreign to the work; all that was necessary was to provide some sort of a sample from a certain depth, the chief consideration being that the cuttings were placed in a bag and provided with a label, regardless of whether or not the classification was correct. A haphazard scheme for locating the holes and a slipshod method of correlating results could end in nothing but an incorrect interpolation, so that the final outcome of the so-called "drilling campaign" was the collection of a lot of inaccurate information, secured at a heavy expense. We can recall one case where the drilling results were accepted in good faith, and after considerable money had been spent in carrying out an elaborate plan for mine development it was realized that improper sampling of drill cuttings had given a false estimate to the value of the property.

On the other hand, we know that several individual companies and contract concerns have made a practice of establishing and carrying out well-planned drilling campaigns, and the results obtained have been exactly what was needed for the furtherance of development work, or, with negative findings, the discontinuation of operation on the property. Such conclusions only clinch the argument that in mining or in any enterprise a well-planned scheme must be started with a regard for regularity and careful attention to detail *from the beginning*.

WHAT OTHERS THINK

The Tariff on Minerals

I have just read with considerable interest the article entitled "The Tariff on Minerals," which appeared in *Engineering and Mining Journal* of June 11. As a member of the mining profession and a constant reader of your publication I have learned to look upon it not only as a reliable disseminator of news of the mining industry, but also as the exponent of those fundamental principles of right and fairness that should always be maintained. I have assumed that statements and arguments appearing in its columns are literally and technically correct, and that its editorials are free from bias or special interest and that under no consideration would the *Journal* stand sponsor for a policy that is inimical to the mining industry in America, which it essays to support.

After reading the article carefully and analyzing it I am fully impressed with the fact that while it purports to be an unbiased discussion of the subject of a tariff on minerals, it does not state the situation fairly or correctly and should not be permitted to go unchallenged.

I will not attempt to dissect the statements made in the discussion of each of the minerals enumerated, but I take exception to some of the general statements regarding a tariff on minerals and particularly some statements made with reference to manganese.

The article opposing a tariff on minerals attacks the testimony and briefs presented to the Ways and Means Committee and charges distortion of facts, implying that these distortions of facts were peculiar to the proponents of tariffs. The most flagrant distortion of facts coming within my observation (and these distortions are now subject to inspection in the printed reports and the briefs on file) was displayed by opponents to a tariff on minerals. For instance: The opponents to a tariff on manganese ore at one hearing said there was no manganese in this country worth protection. Inside of thirty days these same people filed a brief attempting to prove that there were such large quantities of manganese ore in the West owned by a large copper company that if more than a nominal tariff was imposed on manganese ore it would give this company a monopoly and put all the other producers of ore and all other manufacturers of manganese alloys out of business. Another instance: An opponent of protection for manganese ore stated that the 305,869 tons of manganese-bearing ore produced in the United States in 1918 included the "manganiferous ores unfit for ferromanganese," whereas the truth of the situation is, as disclosed by reports of the U. S. Geological Survey, the domestic manganese ore produced, including the manganiferous ore, was 1,476,331.

What greater crime is there in an academic discussion of a subject than to impugn the motives of the opposition by alleging personal interest, while the author by implication hoists a banner of altruism and public interest; and then, with the reader's mind compliant, delivers in rebuttal a dissertation pregnant with subtle bias and prejudice?

The subtitle of that article "Tariff on Minerals" would indicate, together with the context of the opening five paragraphs, that the author, in launching his attack on the proponents of a tariff, is referring to the questions raised by the "pleaders" for a tariff on minerals. Therefore, one must assume that the following quoted statement refers to multifarious mining industries. "No man can know the conditions surrounding all the multifarious industries of this country, and no man can visualize the ramifying effects of a tariff." With this statement I heartily agree.

My mind fails to respond to the erudite elucidation of the next four paragraphs and accept as a result the statement, "perhaps no industry offers simpler conditions for weighing the application of a tariff than the mineral industry"; *quod erat demonstrandum.*

The mining men who ask for a tariff on their respective ores, *ipso facto* admit their financial interest. They play above board. They present their side of the case. They try to meet the arguments of the manufacturers who use, and the importers who import, and the brokers who deal in, the raw minerals, and who, first hand, are the ones who pay the duty imposed by a tariff on minerals. They very properly show what the cost of a particular duty would be on the consuming public.

The producers of domestic manganese ore, who have invested approximately $15,000,000 in this industry, very properly submit for the judgment of the public whether the tariff on manganese ore, which will increase the price of a hundred pounds of hay knives and similar hardware 2½c., for the protection of the American miner, or $16 for the benefit of the manufacturer, is the greatest straw that is likely to break the camel's back. In a less highly finished commodity like steel pipe the duty of 1¼c. per lb. on the manganese content of ore would increase the cost of pipe (assuming a 25 per cent loss of manganese in smelting this ore) 25c. per ton. The present duty under the tariff act of Oct. 3, 1913, now in force, for the benefit of the manufacturer, increases the price of steel pipe approximately $9 per ton.

It is indeed fortuitous for the sake of those who are opposed to a tariff on minerals that the author of that article opposing a tariff on minerals is a conservationist. For no one who believes in that fundamental principle enunciated by the founders of our Republic, which encourages the development of our natural resources, would otherwise single out for conservation that "wasting asset," manganese ore. I dare say he would advocate the closing down of our iron ore mines of the Lake Superior region, the copper mines of Montana, Utah and elsewhere, "less we rob our children" of their heritage. I cannot restrain from the use of that inelegant expression "bunk."

One is impelled to ask himself if the author of that article was not writing propaganda for the benefit of the users of raw materials, the importers and the brokers, rather than presenting an unbiased exposition on the subject for the benefit of the public.

I am gratified to note that he classifies manganese under that group "insufficient known quantity except at artificial prices." He did not have the temerity to pull out that phantom "no manganese to protect" that was so frequently displayed in the early opposition to a tariff on manganese.

I fully agree with him that this industry requires an artificial price for protection against ore mined with cheaper foreign labor. It is on this same ground that the manufacturer of hay knives, pipe, picks and shovels, and thousands of other iron and steel products demands protection against foreign labor.

The author mentions the large deposits of manganese (rhodochrosite) ores at Butte and Philipsburg, Mont., but he says "the mining is expensive." According to the reports of the Bureau of Mines and the evidence submitted to the Ways and Means Committee, nowhere in the United States was manganese ore produced more cheaply than in the Montana districts in 1918.

To illustrate the possible early depletion of his gamut of minerals he refers to the exhaustion of the Lake Superior iron ores. He deprecates the fact that beneficiation of these ores has already begun. Would not a true conservationist welcome the saving of our national resources? We are today wasting millions of tons of 40 per cent iron ore by gutting out the higher grades and caving in the lower grades and we are using immense quantities of these lower grades for building roads in the iron districts. Our present standards require an iron ore containing approximately 50 per cent natural iron content, and on the basis of 1,400,000,000 tons of ore reserves of this grade in Minnesota, and the anticipated yearly consumption, these reserves will last less than thirty years, but if we beneficiate these ores by washing, by magnetic separation, and by other proved means, it is estimated that our reserves in the Lake Superior region are sufficient to last this country for two thousand years.

There are enormous tonnages of manganese ore in the 1,181 districts examined and reported by the Geological Survey in the United States. A considerable proportion of the tonnage is of high-grade ore. With the proper beneficiation of the lower grades there are sufficient reserves, once they have been developed, to last for many years, and manganese would be an exception to the rule if mining operations on a substantial stabilized scale did not lead to the discovery of larger deposits and higher grades of ore than have been produced under the past erratic conditions of foreign competition.

Of the country's ability to produce manganese ore, we have only to refer to the achievement during the war period, when the price of ore was set by the Government at a higher value and the industry was stabilized by an attempt to regulate imports.

MANGANESE AND MANGANIFEROUS ORE PRODUCED IN THE UNITED STATES 1914 to 1918 (IN GROSS TONS)

Year	Ore Containing 35 per Cent of Manganese or More	Ore Containing 10 to 35 per Cent of Manganese	Ore Containing 5 to 10 per Cent of Manganese
1914	2,635	91,666	6,599
1915	9,613	180,953	13,786
1916	31,474	453,853	89,447
1917	129,405	730,759	130,044
1918	305,869	916,163	252,615

In the program which produced such noteworthy increase of manganese ore no districts were exhausted. As a matter of fact, the manganese mines were only becoming fairly well opened up. Some districts in 1918 produced but little more ore than in 1917, due to the fact that most of the efforts were being put forth in mine development and the construction of beneficiating plants. Had the price and the demand remained another year, 1919 would have seen a production of double the amount of ore produced in 1918, with a capacity for production in succeeding years which would soon meet the requirements for more than half of our annual domestic consumption.

The present schedule of tariff asked by the proponents of a tariff on manganese ore would establish a price of less than one-half the war-time price, and will protect an investment of American citizens in American industries of approximately $15,000,000. It will not exhaust our domestic reserves, but will lead to their development, so that should war again involve our land American victory would not again be jeopardized and the country confronted by the serious plight that existed in our recent war with the Central Powers, on account of the scarcity of manganese.

Deerwood, Minn. CHARLES W. POTTS.

On the Maverick Nature of Balls

In *Engineering and Mining Journal* of June 4, Mr. Stevens agrees with Mr. Wraight that home-made milling machinery parts are better than standard and then gives, as a contrast, the use of manganese steel camshafts (not home-made) as giving better results than home-made ones. Possibly this can be explained as follows:

Consider balls, as used in ball mills. Of what are they made? Who will dispute that a ball, to give good results, should be made of good material to begin with, and should contain the proper percentage of carbon, chromium, nickel, or other alloy to give it hardness and strength. But are all balls made in this way? What maker will step forth and guarantee that the balls he offers for sale (1) are made from iron bought for the purpose; (2) contain (here give the percentage of alloy); (3) are properly forged; (4) are not made of old steel, open-hearth car axles, or crop ends; (5) are not made of steel that was made for another purpose and rejected; (6) are not an outlet for his scrap and waste; and (7) are guaranteed always to be alike.

Old car axles are made of open-hearth steel containing a small amount of carbon, and are very soft. The tool steel that turns them contains almost twice as much carbon and is therefore hard enough to cut the soft steel. Balls usually contain from 0.6 to 1 per cent of carbon if they are of good-quality steel. Practically all steel mills sell alloyed steels on analysis: if the alloy or alloys called for are not present in the quantities specified, the steel is rejected. A large amount of this rejected steel is sold for the manufacture of balls or other forgings at a sacrifice. The owner of a small forge cannot support a steel furnace and must buy his steel wherever it may be had at the lowest price.

Shoes and dies for stamp mills are usually a little better made than balls; also liners for ball mills. But balls have been made from anything called steel, with a carbon content varying from 0.2 to 1 per cent; chromium in chrome-steel (?) balls from nil to 0.05 per cent; and in some balls, chromium, manganese, and nickel occur only as an impurity or accident.

Manganese steel can be made in only one way, and may easily be tested. Unless the manganese content is around 13 or 14 per cent, the steel is not non-magnetic. Therefore manganese steel is always the same and reliable, but has not proved successful for balls, although some has been used for shoes and dies. Under hammering shocks, manganese steel peens or flows, and this prevents its use for a great many purposes.

The point I want to make is that if the makers of steel other than manganese will standardize their products, sell on analysis, and tell the purchaser what he is buying, the competition of home-made and local material will largely be eliminated, to the advantage of both buyer and seller. EDWARD W. LAWLER.

New York City.

UNDERGROUND WORKINGS, AVERY ISLAND SALT MINE

Salt Mining in Louisiana

Peculiar Geological Formations Which Have Been Worked—Room-And-Pillar Method Used, Timbering Being Unnecessary—District Has Large Reserves, but Is Not Now an Important Producing Center

BY ALBERT G. WOLF
Written for *Engineering and Mining Journal*

MUCH HAS BEEN WRITTEN about the production of oil from the coastal salt-dome fields, so that a person unacquainted with the subject is inclined to wonder why salt, too, is not a product of these queer formations. In Louisiana, salt *is* produced from some of these domes, and the method of extraction is unique, in the United States at least, not because of the fact that underground mining is employed, but on account of the nature of the deposits, which permits the methods of mining locally practiced.

Gulf Coast salt domes, roughly speaking, are irregularly distributed over an area about seventy-five miles wide, bordering on the Gulf of Mexico, and extending from the Atchafalaya River, in Louisiana, to the Rio Grande. By far the larger number of these domes is found within the portion of the strip between the Atchafalaya River and a point just west of the Colorado River of Texas. Within this belt are thirty or more proved salt domes. Of this number only two are producing salt, a third has produced a considerable quantity by underground mining, and a fourth is being developed. These four domes are all in the interesting group known as the Five Salt Islands of Louisiana.

A brief description of salt domes in general is necessary to convey to the reader an understanding of the nature of these queer formations, and to show the difference between most of them and the salt-producing "islands." Two types of salt domes occur in Louisiana and Texas, those of the coastal region and those of the hill country, farther back from the coast. Only the former will be here considered.

The principal structural feature of each of these coastal domes is the immense central core of practically pure rock salt. In the different domes the core may vary in shape from roughly circular to somewhat elongated, and in size from one-half a mile to two miles across. The top of some of these cores extends within a few feet of the surface, and in others is buried under two or three thousand feet of recent sediments. Usually it is comparatively flat on top, sloping away from the center in all directions, dipping more steeply on the flanks, and in some formations standing almost vertically at the extreme outer limits that have been reached by drilling. The depths to which these cores extend is unknown. So far as I have been able to learn, the deepest well drilled in salt was at Humble, Harris County, Tex., where a well struck salt at about 2,000 ft. and was abandoned at 5,410 ft., still in salt.

CAP ROCK OF GYPSUM, LIMESTONE, DOLOMITE, AND ANHYDRITE

Above the salt core there may or may not be cap rock, a layer of rock covering most of the upper portion of the salt core, and usually lying directly upon it, although in some instances a little sand intervenes. When present, it is composed of any one or all of the following minerals: Gypsum, limestone, dolomite, and anhydrite. Usually the portion of the cap rock composed of calcium sulphate is next to the salt, with the carbonate minerals above. The most peculiar feature of the cap rock is its lack of correlation with any stratum in the whole series of sediments in the coastal

region, indicating that it is invariably of local origin and extent.

Surrounding the salt plugs are sediments of the Tertiary and Quaternary ages, with unconsolidated Quaternary sediments overlying them. The surrounding sediments have been broken through by the salt plugs, and bent upward, and the overlying sediments have been domed, the whole forming a quaquaversal fold. This structural dome may or may not extend to the surface,

MAP OF PART OF LOUISIANA, SHOWING VERMILION, IBERIA, AND ST. MARY PARISHES

forming a topographic dome, although it does so in most of the formations here discussed.

Oil and Sulphur of the Salt Domes

In addition to salt, other useful minerals found in these structures are oil and sulphur. Oil is found in the comparatively shallow sediments overlying the cap rock, in the cap rock itself, and in the abutting strata at greater depth. Sulphur is found in the cap rock, almost entirely in limestone and gypsum.

The origin of the salt domes is an unsettled question too complicated to go into here.[1] The theories of formation vary from the evaporation of sea water to the intrusion of salt in a molten or plastic state, with various causes for the intrusion, and to the growth of salt crystals after primary deposition. None of these theories, however, satisfactorily accounts for all the features of the domes. It is quite evident that the salt penetrated some of the overlying strata and arched others. Compared with these strata the salt must be of secondary origin, and the cap rock of tertiary (with a small "t").

The major points of difference between the domes now producing salt and most of the coastal oil-producing domes is the much greater height of the topographic elevations of the salt domes, the slight depth of the salt cores, and the absence of cap rock.

Situation of the "Five Salt Islands"

The two salt structures which alone of all the coastal domes are producing salt in commercial quantity are arranged in practically a straight line forty-five miles long and extending almost due northwest and southeast near or on the Gulf coast in Vermilion, Iberia, and St. Mary parishes, La. (See the map.) Jefferson Island, or Côte Carline, the farthest one to the northwest, is on the boundary line between Vermilion and Iberia parishes, and just south of the thirteenth parallel and east of the ninety-second meridian. Then, in order named, and about seven to eight miles apart, in an air line, are Avery Island (Petite Anse), Week's Island (Grande Côte), and Côte Blanche, the first two in Iberia and the last in St. Mary parish. Belle Isle, also in St. Mary parish, lies about as far southeast of Côte Blanche as that place is from Jefferson Island.

Salt Mining Dates From 1791

So far as I am able to determine, the first salt produced in southern Louisiana was obtained at Avery Island, or Petite Anse, as it was then called. Apparently it is not known when the "island" was discovered, but it is stated that it was settled about 1791, and that the owner, one John Hayes, discovered on it salt springs. Salt was extracted from the waters and sold locally. Later, especially during the War of 1812, the production was increased, but was still from brine. In 1818 the "island" came into the possession of one Avery, from whom the now commonly used name of the locality was derived. Although the extraction of salt from brine still continued, no great effort was made to increase the production until 1861 or 1862, when the salt supply of the Confederate Army was cut off. An attempt was then made to increase the flow of brine by deepening a well, with the result that rock salt was discovered 16 ft. below the surface. The Confederate government then took possession and carried on underground mining operations until the Union forces destroyed the works in 1863. The mine was reopened in 1879, and somewhat later a branch of the Southern Pacific RR. was built in from New Iberia, ten miles to the northeast. Mining was carried on practically continuously until 1898, when the lessees, Myles & Co., surrendered their lease. In July of that year the owners of the property organized the Avery Salt Mining Co. and sunk a new shaft, which has been in operation since 1900.

Between 1895 and 1897 rock salt was found in drill holes sunk on Jefferson Island, Belle Isle, and Week's Island by Captain A. F. Lucas, an ardent student of salt-dome formations, and the first to advance and prove the theory that the coastal salt domes constituted formations favorable for the collection of oil. The main salt core has not been found by drilling at Côte Blanche, where it is either considerably deeper than in the other domes of this group, or else out under Côte Blanche Bay.

In 1920 the Jefferson Island Salt Co. began active operations to develop its deposit, and started shaft sinking. At Week's Island, the Myles Salt Co. began operations in 1898 after surrendering the lease at Avery Island, and that company has produced salt by underground methods ever since.

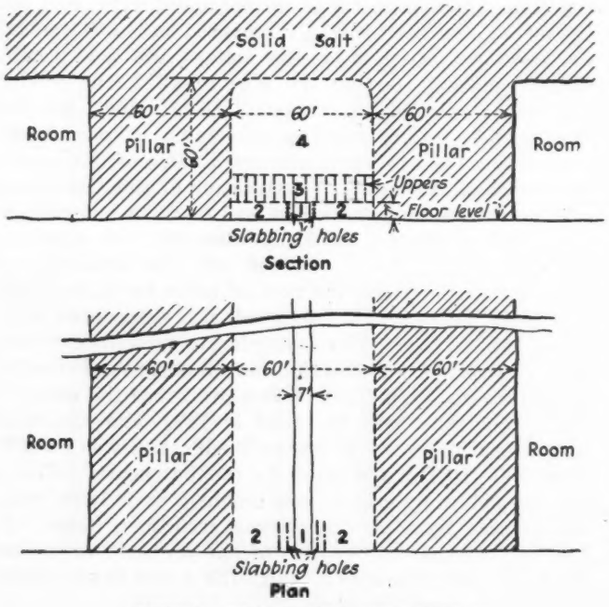
Attempts in the past to develop three different minerals at Belle Isle have made this island's history most

[1]Further information is available in Bull. 669 of the U. S. Geological Survey, "Salt Resources of the United States," by W. E. Phalen.—Editor.

varied and interesting, but little has been produced. After the discovery of salt late in 1896 or early in 1897, Captain A. F. Lucas, the discoverer, drilled three more wells. This drilling was followed by a series of thirteen by the Gulf Co. In August, 1898, this company started to sink a shaft to exploit the salt deposit proved by drilling, and completed it to 390 ft., striking the salt at 103 ft. Lateral development was carried too far, running beyond the salt into the unconsolidated formations, and quicksand and water filled the workings. A second shaft was abandoned on account of quicksand before reaching salt. Then, after considerable expenditure for evaporating equipment, storage, and shipping facilities, salt was produced from brine wells. These operations were soon given up, however, on account of impurities in the product, such as oil and iron stains, caving of overburden and escape of brine in the loose sediments.

Oil Sought in Louisiana Domes Fifteen Years Ago

In 1906 more drilling was done, this time by the New Orleans Mining & Milling Co. Two wells were put down at the north end of the island, evidently with the idea of finding oil at depth. One of these wells, less than 1,000 ft. north of the old salt mine shaft, failed to reach salt at a depth of more than 2,400 ft. In 1907 and 1908,

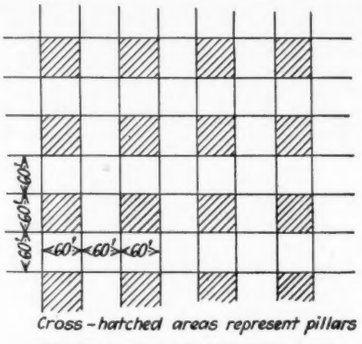


SKETCH OF METHOD OF MINING

I. N. Knapp drilled three wells, with the hope, in one operation at least, of finding oil below the salt. This well, near the old shaft, struck salt at 140 ft. and continued in it to 3,171 ft., with some limestone and anhydrite reported to be scattered through the last few hundred feet. A little very light oil was found in this well. In 1916-17 Lucas drilled a second series of wells, this time to determine the extent of the sulphur-bearing horizon. The work done, according to Lucas, proved this to be of insufficient extent and commercially unimportant.

Early in 1920 the Union Sulphur Co., of Louisiana, acquired title to the island, and began, according to rumor, what was to be a thorough test of the entire dome for sulphur. Drilling was under way in November, 1920. Belle Isle is the only one of the Five Salt Islands that is really an island, and the only one, so far as I know, upon which either sulphur or oil has been found.

The two operating salt mines are at Avery Island and Week's Island, operated, respectively, by the Avery Salt Mining Co. and the Myles Salt Co. The surface of the Avery Island dome is about ont and one-half miles in diameter and rises to a height of over 100 ft. above sea level, and nearly as much above the surrounding marsh land. The salt, at its highest point, is within



GENERAL PLAN OF PILLARS

16 ft. of the surface, and although not at the highest point of the hill, it is near enough to bring the top of the salt core above sea level.

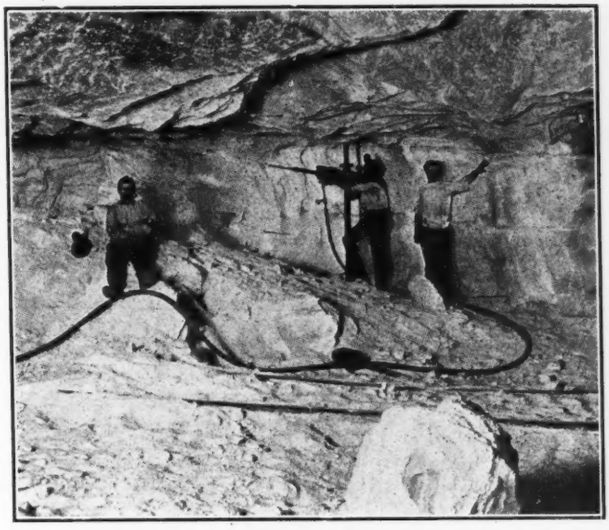
The surface is largely covered with yellowish or brownish loamy soil, with sand, gravel, and clay in places. The sediments encountered in shallow work are all believed to be Quaternary.

Room-and-Pillar Method of Mining Used

The present shaft was put into operation in 1900. It is of two compartments, vertical, and about 500 ft. deep. The method of mining is simple. After providing for adequate haulageways at the bottom of the shaft, and leaving pillars of proper size to protect the shaft, parallel drifts are extended 60 ft. wide and 60 ft. high (these are probably more properly called rooms). Then half the remaining pillars are removed by driving breakthroughs 60 ft. wide, leaving one-quarter of the original area in the form of pillars measuring 60 ft. in all three directions. (See accompanying diagram.)

The method of advancing the rooms is shown in detail in the sketch. First a central drift about 7 ft. x 7 ft. is driven any convenient distance, removing the portion marked 1. Then successive sets of slabbing holes are drilled and shot either side of this preliminary drift until the room is undercut its full width and the depth of the holes. As the broken salt is removed, further sets of holes are drilled, until the whole room is undercut; that is, until the portion 2-2 is removed. Then section 3 is broken by means of uppers, the first row being drilled just back of the open face of the room and pointing slightly toward it. Work is then continued from the top of the broken salt and from high ladders, and horizontal slices above 3 are shot down until the room has been raised to a height of 60 ft. in the center and a little less at the sides, forming a slightly arched roof. Sufficient salt, of course, is removed all the time to permit the continuance of work. Before clearing the rooms of broken material, the roof and walls are carefully trimmed to remove all loose pieces. The salt, being absolutely dry, will stand indefinitely without sloughing. The break-throughs are driven in the same manner as the rooms.

All this work is carried on without leaving a stick of timber anywhere in the rooms, and when a person, even



MAKING AN UNDER CUT

though acquainted with underground workings of nearly every description, first sees the sparkling, blue and white mottled walls and roofs of this series of immense corridors extending in all directions, absolutely free from support, he is astounded at the operations.

Drilling is done with air-driven augers, and great footages have been made, as much as 100 ft. per hour. Blasting is done with low-grade dynamite, detonated by means of fuse and cap. All shoveling is done by hand on contract, and mule tramming is employed.

The surface equipment is housed in one large building called the "breaker." It consists essentially of three sections, the engine room, the headframe and crushing plant, and the sacking department. The headframe is about 100 ft. high. Hoisting is done in counter-balance with steam. Single-deck cages are used, and the salt is hoisted in mine cars.

The cars are dumped at the top of the breaker over a grizzly and the oversize runs into a large set of toothed rolls. All the salt then passes through a second set of rolls, over coarse screens, and the oversize to a third set of rolls. The material next passes through a series of screens and disk grinders, where several sizes of salt are made, ranging from table salt to coarse sizes for packing and for ice cream, and having various technical names. The intermediate and medium fine sizes are used, but the very finest is rejected in order to clean the salt, as it carries with it all the powder-stained material. The color of this reject, where it is sluiced out of the mill, is a dark gray.

The process of cleaning is further aided by hand-picking. This is done at the first grizzly and in a traveling belt after the salt has been reduced to about one-half inch size. Foreign particles picked out consist mostly of pieces of powder, burned fuses, and chips of wood from mine cars, ladders, and scaffolds.

The various sizes of screened salt fall into hopper-bottomed bins, from which the salt is drawn into sacks and weighed. Besides the classes of sized salt, a considerable quantity of rock salt in large lumps is shipped. All of this salt is of high purity.

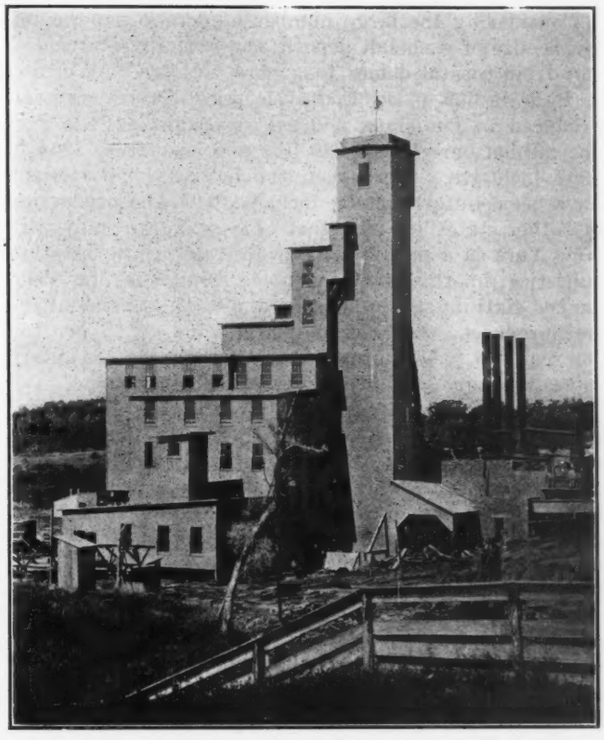
It is planned to install electrical equipment throughout the mine and mill, which will be much more economical and efficient than the equipment now in use, especially simplifying the mill drive.

Mining operations have been carried on for twenty years from one level, and over a million tons of salt has been shipped. The salt core is said to be about one mile long and one-half mile wide, and has been drilled to a depth of 2,000 ft. without "striking bottom." This would indicate a reserve of approximately 200,000,000 tons. The present management is not worried about next year's supply of "ore."

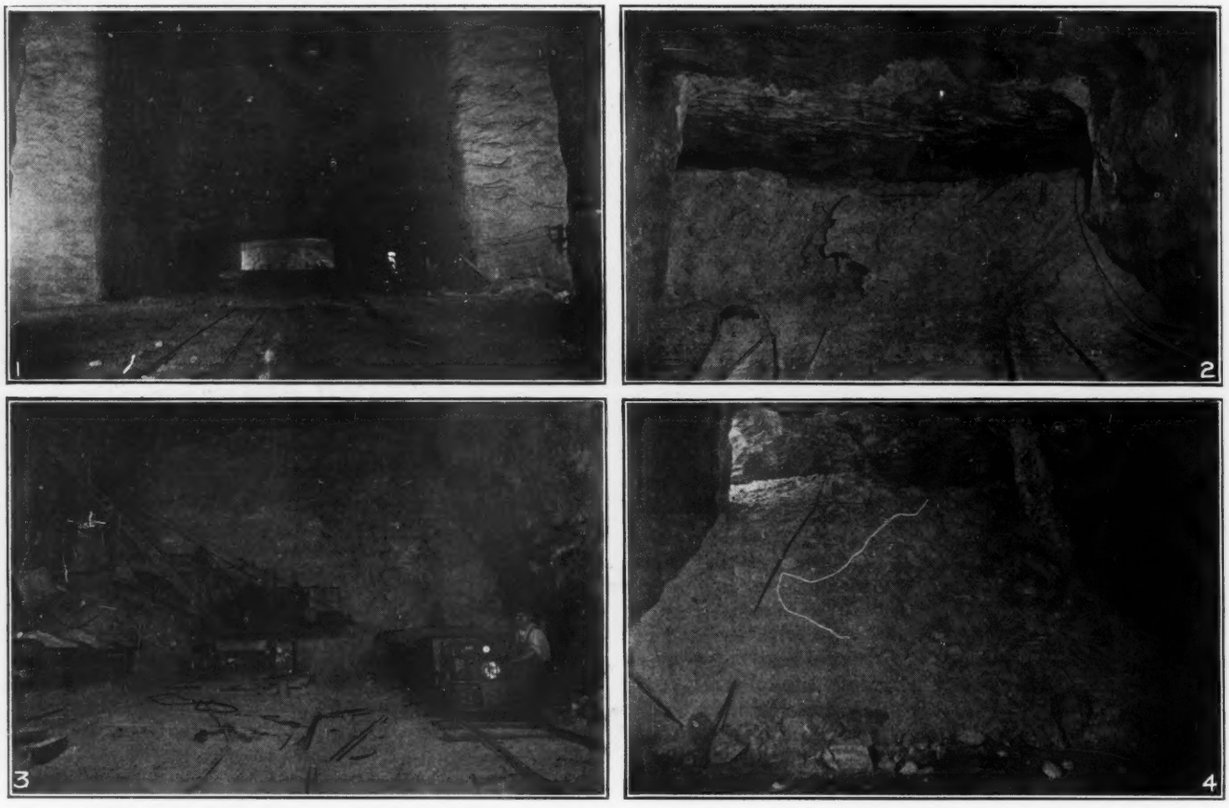
Operations at Week's Island Similar to Those of Avery Island

Week's Island was originally called Grande Côte, because of its size, as it is the largest of this group of domes. The surface of the dome is roughly circular in outline, about two miles in diameter, and rising to an extreme height of 120 ft. above sea level. The strata overlying the salt, as at Avery Island, are all unconsolidated and all belong to the Quaternary. The chief structural difference between this and the Avery dome is that the salt core is somewhat deeper, being 90 to 100 ft. below the surface at the apex of the core. The top of the salt core does not correspond to the topography of the surface, as might be expected, the apex of the core being near the southwest side of the hill, with the steepest slopes to the south and west, and the most gentle to the north.

Mining operations began in April, 1898, when the Myles Salt Co. sank its first shaft. Considerable trouble was experienced in making a "tight seal" between the overlying strata and the salt, on account of quicksand. This seal is absolutely essential in salt mining, to exclude the surface waters from the salt mass. The methods employed by the Myles Salt Co. are, in general, similar to those used at Avery Island, except that electric power is used for all mining and milling operations other than hoisting. Electric-driven shoveling machines, and electric augers and locomotives are used, and the shots are fired by electricity. There is an unaccountable



THE BREAKER OF MILES SALT CO., WEEK'S ISLAND, LA.



1—INTERIOR OF A WEEK'S ISLAND SALT MINE. NOTE FIGURE OF MAN IN FOREGROUND. 2—ENLARGING A ROOM. 3—ELECTRICALLY DRIVEN SHOVEL AND STORAGE-BATTERY LOCOMOTIVE. MODERN UNDERGROUND EQUIPMENT. 4—SIMILAR TO FIG. 2. WORKING ON A SALT PILE

difference between the salts produced at Avery and Week's, the latter being crumbly on exposure, necessitating the shipping of compressed-salt bricks instead of lumps of rock salt, as at Avery Island.

Considering the large number of domes and the immense size of each salt deposit, the actual production of salt from coastal domes is a mere nothing. According to Bulletin 669 of the U. S. Geological Survey, the salt produced in Louisiana and sold averaged a little over one million barrels (of 280 lb.) per year from 1904 to 1907 inclusive. Since then the figures for Louisiana have been, unfortunately, included with the production of "other states" or with that of New York. Why with New York is a mystery. However, according to other statistics in this same volume, Louisiana, in 1917, ranked sixth in salt production and sixth in value of the salt produced, the average price being $3.37 per ton for rock salt. As equipped, both the Week's and Avery mines are capable of producing 500 tons per day.

There is an immense store of available salt in the domes of Jefferson, Avery, and Week's islands, and with the advantages of such large bodies of pure rock salt so close to the surface it is difficult to see why this salt cannot compete with Northern salt over a wider range in the South. Perhaps a comparison of the ratio of cost of production to railroad rates would explain the situation.

Aside from their scientific and economic interest, these so-called "islands," rising as prominent topographic features from their marshy surroundings and covered with semi-tropical vegetation, including immense live-oak trees draped with Spanish moss, appear to the visitor as gems of beauty—if he can forget the bugs.

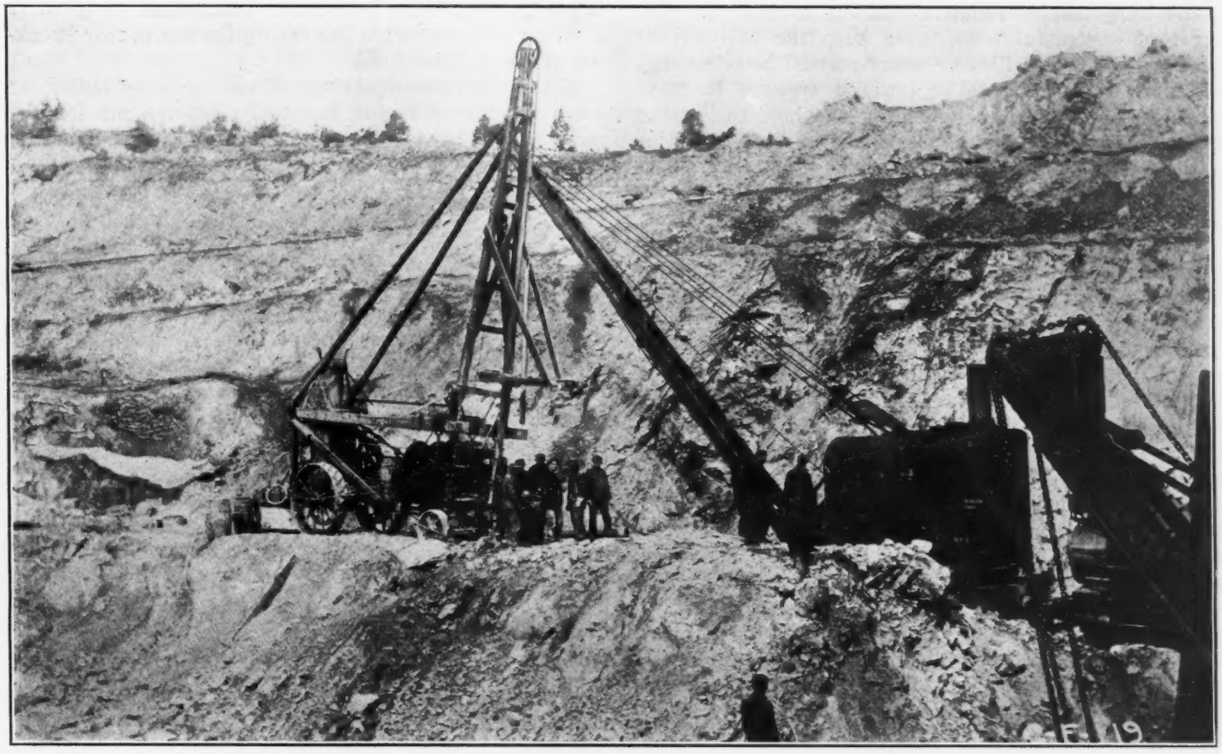
The World's Output of Aluminum Greatly Increased

The importance of aluminum, particularly as a substitute for copper during the war, led to a marked increase in the output by the leading producing countries. According to an article in *Elektroteknisk Tidsskrift*, which has been abstracted by *Technical Review*, London, the following table gives the pre-war output and the increase during the war and the production as estimated for 1920, in tons, the pre-eminence of the United States in all of the periods for which figures are given being noteworthy:

WORLD'S ALUMINUM PRODUCTION

Country	Pre-War Production	Increase During the War	1920 Production
Germany	1,000	39,000	40,000
Austria-Hungary and Switzerland	11,000	14,000	25,000
France	18,000	2,000	20,000
England	7,500	4,500	12,000
Italy	1,000	6,000	7,000
Norway	1,500	14,000	16,000
United States	28,000	45,000	73,000

The total production thus increased by more than 100 per cent during the war, and includes countries where copper was readily procurable. It is maintained in Germany that aluminum in many respects is equal to copper and even superior as regards strength, continues the article. Aluminum wire is coated with copper or tin when soldered electrical joints are required. Welded joints have the same strength as the wire itself. Aluminum recently entirely superseded copper in a synchronizing transformer of 38,000-kw. capacity made in Europe.



PUTTING DOWN A CHURN DRILL HOLE IN A WESTERN OPEN-PIT COPPER MINE

Churn Drilling of Disseminated Copper Deposits*—II

Casing Troubles and the Proper Procedure in the Handling of Casing—What To Do About Lost Tools—Records, Samples, Cross-Sections and Assaying of Samples—The Value of the Triangulation System in Drilling Work

BY E. R. RICE
Written for *Engineering and Mining Journal*

IF THERE is one thing in drilling that gives more grief than any other cause it is the use of casing which is too light for service. The light, small-threaded casing is cheaper as to first cost, but the interest to be paid on the difference in original cost between light and heavy casing is astounding. The delays, accidents, loss of casing, fishing jobs, and other troubles directly and indirectly attributable to the use of too light casing will run into several times more money than the cost of good casing in the beginning.

A casing shoe should be used on each string unless it is positively known that the under-reaming will not have to be used. The shoe should be made up with the engine and then babbitted on.

In lowering casing into the hole the mast of the traction-type drill is usually too light to support the weight of the casing. There are two alternative supports that will usually answer, the choice depending on the weight of the string to be handled. Ordinarily it will suffice to stand the large string of drilling tools up in front of the mast and use them as a gin-pole to carry the major part of the weight. One of the casing blocks is attached to the rope socket of the drilling string, and by this arrangement all the weight supported by the mast is that disposed at the live end of the casing line. The drilling string should be chained to the mast and the two securely blocked apart by means of blocks and wedges to make the whole more rigid. The other method of support is the erection of a bent of 12-in. x 12-in. timbers over the hole. In putting casing in, each joint should be measured and entered in a book kept at the rig for that purpose.

With the ordinary type of traction drill it is necessary to disconnect the drilling line from the rope socket and use the drilling line as a casing line or to spool the drilling line on one end of the drum and put the casing line on the other end. Where the ore lies deep, or the ground is bad and much casing has to be handled, it may be advisable to employ a portable drill having an auxiliary calf reel. This allows the casing to be handled independent of the drilling string.

No special directions are necessary concerning the putting in of casing, excepting to make the joints tight. After the casing reaches the bottom, it is usually turned loose and allowed to follow down the hole as far as it will, putting on new joints as the string descends.

KEEP CASING FREE, A GOOD RULE TO FOLLOW

Sometimes casing may be driven a considerable distance, but this practice is not to be recommended excepting in special instances, especially for shutting off

*Continued from the issue of June 25, 1921.

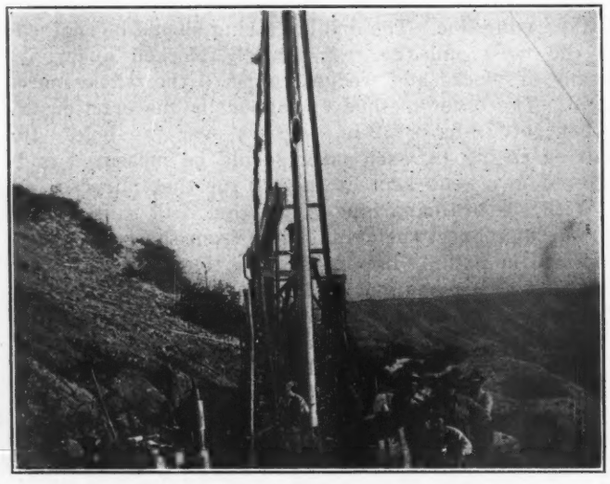
a cave or getting through a running formation. The secret of successful work is to keep the casing free and have the hole drilled or under-reamed large enough to permit the casing to be lowered freely. It often happens that after under-reaming the hole the casing refuses to go down, this being caused in most instances by the casing being frozen in the hole. Instead of driving the casing, the proper procedure is to raise it until the material behind it falls into the hole, thereby freeing the casing. Of course, if the ground above is bad and will not stand, the proper thing to do is to drive the casing. This is an instance where the heavy casing is especially desirable.

Most casing troubles start after the hole is finished and the pulling of casing has begun. In the formations encountered in prospecting for copper, casing is prone to freeze in, due to the character of the rock encountered. If the formation is wet, shattered rock will settle around the casing and hold it in an iron grip.

To give an illustration of the above, I will cite the following instance from my own experience: We were pulling 10-in. casing weighing 37 lb. per foot and were jacking the string with four 50-ton hydraulic jacks, taking all the strain possible with the jacks. Besides that we had a casing spear in the next to the last joint, jarring all a No. 24 Star rig would stand and using a 20-ft. 4½-in. stem and 24-in. stroke jar. Suddenly the strain eased up, and the casing could be easily jacked with one pair of jacks and without the aid of the spear. When we got the string out we found we had left the last joint in the hole, it having broken off under the coupling. The intense strain necessary to cause this was due to the freezing in of *one joint only*.

Casing Should Be Pulled With Care

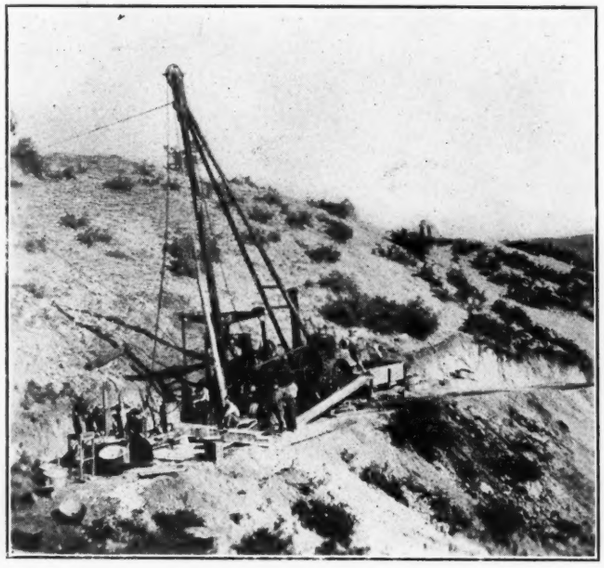
In starting to pull casing it is always best to try first to move it with a block and tackle. If the casing will not come, then use hydraulic jacks, taking as much strain as the casing will bear. Care should be taken that the strain put on the casing is not so severe as to



FRONT END OF A TRACTION DRILL

cause it to part. The amount of strain a string of casing will stand can be told only by experience in this sort of work. If jacking will not bring the casing it will then be necessary to go in with a casing spear or friction hold and try a combination of jacking and jarring. If no spear is available and a friction hold is taken it should be previously determined that there is plenty of room below the casing for the proper breaking of the friction hold.

If there are many strings of casing to be pulled, or much jarring of casing has to be done, a pit for the jacks should be dug below the level of the floor at the



CHURN DRILL, WITHOUT HOUSING, IN OPERATION

start. This allows the jacks to be set below the level of the floor and permits the casing to be jarred to greater advantage. Several nipples of different lengths should be on hand for each string of casing, so that, as the casing is jarred up enough to interfere with the working of the temper screw, the top nipple can be taken off and a shorter one inserted. In the event that the casing cannot be pulled by a combination of jacking and jarring, it will be necessary either to shoot off or cut the casing at some point below the bottom of the next larger string.

The point at which the string is frozen can usually be determined by the use of the casing spear. If, when jarring with the spear, a definite impulse reaches the top of the casing at each stroke of the jars (told by holding the hand on the casing), the casing is frozen below the spear. If only a weak impulse reaches the top, the casing is frozen above the spear.

One Method of Cutting Casing

Casing is cut by running in a casing cutter on a string of 2½-in. or 3-in. pipe. In cutting casing the following points should be observed: Take a good heavy strain on the casing by means of the jacks, and after this is done do not raise or lower jacks until after the casing has been cut. Make up each joint of the cutting string very tight, so that there will be no screwing up of its joints after cutting has been started. If this does occur, the cutting string will be shortened, with probable breakage of the cutters and the starting of a cut in a new place. Raising or lowering the jacks after cutting has started will cause the same thing. If cutters are not available, the casing may be shot off, which is easily done in the following manner:

Make a wooden plug the diameter of the casing and drive it down the casing to near the bottom by means of the tools. Then throw sufficient stiff clay and rocks

in the casing to fill it up several feet above the plug and insert another wooden plug in the casing, fitting fairly snug, but not tight enough to prevent the passage of water around it. Then push this plug down to the clay with the tools. After the plug has reached the clay, hook on the beam and drive the plug firmly down. This serves to compress the clay, drive it into all the crevices, and expands the second plug so that it completely fills the casing.

Preparing the Powder Charge

In the mean time the torpedo has been prepared. The torpedo is made according to the following instructions: A casing protector of the next smaller size casing is bored with four horizontal holes at ninety degrees to each other, and through these are placed ¼-in. iron rods. The rods are bent upward and extend about 6-in. above the edge of the protector. They are bent outward at the top and the ends filed to a chisel edge, the sharp edge being outward. Weave a bottom on the protector with baling wire to carry the powder charge and fashion a bale out of wire for attaching the torpedo to the sand line. From the bottom suspend a piece of old iron weighing about twenty pounds to give sufficient weight to the torpedo to cause it to go freely down the hole. By a little cut and try, the torpedo can be made so that it will easily go down the casing, but cannot be pulled up, as the prongs of ¼-in. iron will catch in the first coupling, which is what is desired, the scheme being to shoot the casing in a coupling. One to three sticks of ¼-in. 40 per cent dynamite is securely tied to the wire bottom of the torpedo, and it is then ready for use.

The baler is then strung in and a mark put on the sand line at the point where it is desired to shoot the casing off. All the water is rapidly bailed out of the casing, the bailer taken off, and the torpedo attached to the sand line. The torpedo is then lowered to the desired depth and slowly pulled back up the hole until it catches in the first coupling. Two detonating charges are then dropped in on top of the torpedo. These detonating charges are composed of one-half a stick of powder, blasting cap, and two or three feet of fuse. The fuse should be securely fastened to the powder to eliminate the chance of the fuse being detached while dropping down the hole. Before dropping in the detonators, a heavy strain should be taken on the casing with the jacks.

The reasons for plugging the casing and bailing out the water are twofold. If the casing is shot with water in it, it is likely to split for some distance above the point where the shooting takes place. By having the casing dry the danger of misfires, due to wet fuse and caps, is eliminated.

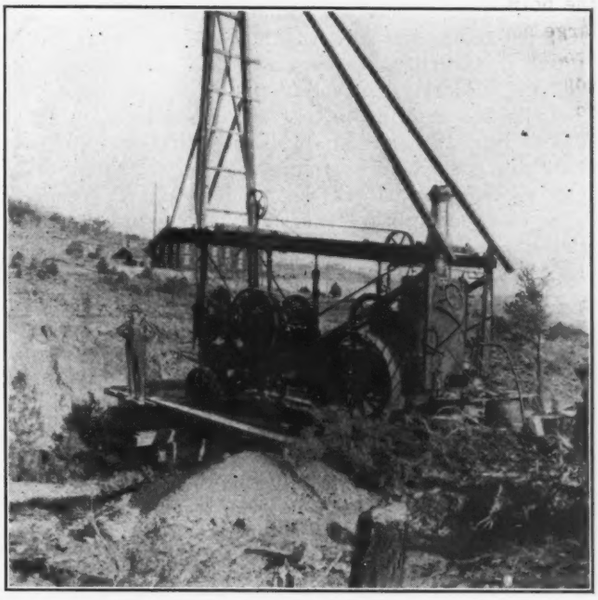
I have never failed to part the casing at the first shot by using light charges and shooting in the coupling as described, whereas in the old method of shooting any place with heavy charges I have seen many failures. The reason for this was that either the casing did not shoot entirely in two or the casing would bell out at the point where it was shot, making it impossible to pull.

Proper Strain on Casing a Matter of Experience

In pulling casing, especially where it is of light weight or old, too great a strain should not be taken on it with the jacks, for if too much is applied the casing is likely to part at some point down the hole, which creates more trouble. The gaging of the amount of strain a string of casing will stand is an art acquired only by long experience. In the event of the string parting, it will generally be necessary to reconnect with the lost string unless the amount left in the hole is too small to be of any moment. When the string parts there is a choice of several different lines of attack, the one to be chosen depending on conditions. If the casing has parted by the pulling out of a coupling, as is usual, it can be connected by using a steel male and female casing nipple on the end of the upper string, a conical wooden plug being inserted in the nipple to act as guide. If no nipple is at hand the casing can usually be connected by using a wooden guide plug in the end of the upper string.

If no connection can be made the proper thing to do is to shoot off or cut the casing at a point below the bottom of the next larger string and lift the casing out, either with a casing spear, or friction hold, or spear on another string of casing.

Fishing is one of the greatest sources of trouble encountered during drilling, and, although fishing jobs are bound to occur, a great many can be saved by proper attention to details. The drillers have a sarcastic saying, "Do your fishing on the derrick floor." If one takes the foregoing expression literally, and applies it, a great many fishing jobs can be saved by intelligent attention to all details entering into the work. A large number of fishing jobs are caused by carelessness, recklessness, and running in bad ground that is known to be dangerous. Fishing jobs are like accidents in mines, and "safety first" goes a long way toward their prevention.



DRILLING HOLE ON EDGE OF AREA BEING CAVED BY MINING OPERATIONS

After a string of tools has been lost it is important not to get excited and do something on the spur of the moment that will make matters worse. Unless there is an imperative need of haste it is wise to go into executive session and figure out all the angles of the situation before proceeding further.

The dimensions of the bailer and drilling string and any changes that may be made in them should

be kept in the casing book so that the driller will be sure of the diameter and lengths of the component parts.

One of the first things to do is to find out how much line is left on the tools, and this can be told by "stringing out." If much line is left, the proper tool to use is the rope spear or rope grab, which will usually recover the lost string unless it is buried. If the tools are buried the problem resolves itself into getting the cable off of the tools, so that a fishing tool may go over them, and loosening the muck around the tools so they may be jarred out. The cable is removed either by clawing it off with a spear and grab, wadding it down, and cutting it up with a rope chopper, spudding it off with a side spud, or drilling it off, or a combination of these methods.

Surveying With an Impression Block

An impression block is run at intervals to show the condition of the top of the tools and their position in the hole. An impression block is a round, wooden block, one end of which is of the same diameter as the drill hole, the other being of the size necessary to fit into the horn or slip socket on which the block is run. The large end of the block is faced square, and tin is nailed around it, the tin projecting about an inch beyond the edge of the block. The end of the block is studded with 8d. nails, the nails projecting about one inch from the block. Into this nail-studded receptacle hard grease is tightly packed. The impression block is run on a horn socket or a slip socket and should be securely bolted in or securely fastened by some means other than friction.

If the tools are square in the hole, when the impression block is run, they will leave the impression of their top in the grease. If they lay over to one edge of the hole they will mark the impression block on its side. From the impression obtained it is possible to estimate the position of the lost tools and their condition, and accordingly decide upon the procedure. After clearing the drilling line from the top of the tools, the next thing is to loosen them so that they may be jarred out when hooked to the fishing string. This is accomplished by drilling beyond them with a regular bit or by spudding around them with a side spud or spear. After the tools are loosened, and the impression block shows that they stand straight in the hole, the fishing tool is placed in action.

If the tools lay against the wall, and the fishing tool will not go over them, they may be straightened up or caught with a wall hook, or straightened up by spudding around them. They may also be "drilled by," so that the lost tools will fall into the new hole in such a position that they may be caught, or they can sometimes be "drilled by" and cased off entirely. Sometimes, when the tools become buried, it is possible to loosen the muck around them with another string and pull them out on their own line.

If the tools get hung up while drilling, and cannot be jarred out in a short time with the drilling jars, it is important that the drilling line be cut at the top of the tools at once. Continued jarring does not help matters and only whips more material from the walls on top of the tools.

The following advice is the result of long experience in drilling bad ground:

Use good equipment and keep all parts of it in good repair.

Inspect the drilling line frequently.

Do not take chances by drilling far ahead of the casing when the ground is caving.

If ground is sticky or cavy, use a sinker bar above the jars.

Have good supply of fishing tools on hand.

If tools become buried while drilling, cut the line at once.

Do not take hold of a lost string with a fishing string until you are sure that the lost string will come. I have seen three strings of tools, one drilling and two fishing, tied to each other and left in the hole and the whole lost right on top of the orebody because some driller took hold with his fishing string before the lost tools had been properly loosened.

Figure out all possibilities to a situation before proceeding.

Preservation of Samples Important

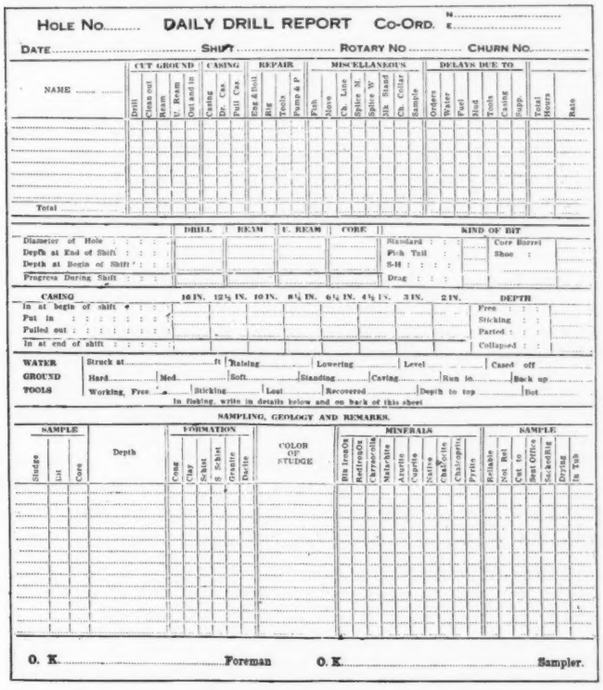
It is of the utmost importance that adequate records, both physical and written, be kept. Churn drilling is one phase of mining operations where statistical records are of more importance than cost records. Physical records consist of sludge samples and of rocks brought up in the bailer from various formations penetrated. After the dried sludge sample has been sent to the assay office it should be crushed so that it will pass a 10-mesh screen, and riffled until enough is left to fill two 6-in. x 12-in. sample sacks. The sample is riffled again and one-half of it is placed in a sample sack, which is stenciled with the number of the hole, the depth at which the sample was taken, and the letter "D" to signify duplicate. The other half of the sample is further comminuted and reduced to a suitable assay size in the regular manner, the pulp being taken for assay. The rejected portion is placed in a sample sack, which is stenciled with the number of the hole, the depth at which the sample was taken, and the letter "O" to signify original. Both original and duplicate samples are then stored in a fireproof vault or building where no one may tamper with them.

The samples should be stored systematically. The best manner is to place them on shelves divided by partitions, each resulting compartment being of the proper size to hold ten samples. Originals are placed on one side of the building and the duplicates on the other. By this arrangement any particular sample may conveniently be picked out at any time. The duplicates should never be opened unless it be absolutely necessary, as they should be reserved for examining engineers in the event of examination for underwriting, sale, or consolidation. If any experimental work is to be done on samples, the originals should be employed. Rock samples are preserved in the same manner as sludge samples.

The records referred to in this paper are strictly of an engineering nature and do not deal with the receipt and disbursement of funds. The accompanying form, Fig. 1, shows the daily drill report. These reports measure 8½ x 11 in. and are the same size as ordinary business letter paper. They are printed in one, two, or three colors, depending on the number of shifts being employed, a different color being used for each shift. White, light yellow and light blue make three satisfactory colors.

I designed this form for either churn drill, rotary rig, or a combination rig where both rotary and churn drill are employed in conjunction with one another. For straight churn drilling, the form can be slightly

modified by eliminating the headings peculiar to rotary drilling. It will be noted that much of the information desired is entered by simple check marks, the remainder consisting of the entry of a few figures. A driller and sampler soon learn to fill in these reports accurately, and as the sheets are turned over to the office every


HOLE NO..... DAILY DRILL REPORT CO-ORD. N..... E.....

DATE..... SHIFT..... ROTARY NO..... CHURN NO.....

NAME .....

CUT GROUND: Drill, Clean out, Ream, U. Ream, Out and in
CASING: Casing, Dr. Cas., Pull Cas.
REPAIR: Eng & Mach, Rig, Tools, Pump & P
MISCELLANEOUS: Fish, Move, Ch. Line, Splice M., Splice W., Rig Stand, Ch. Collar, Sample
DELAYS DUE TO: Orders, Water, Fuel, Mud, Tools, Casing, Supp.
Total Meters, Rate

Total .....

	DRILL	REAM	U. REAM	CORE	KIND OF BIT
Diameter of Hole					Standard
Depth at End of Shift					Fish Tail
Depth at Begin of Shift					S-H
Progress During Shift					Drag

Core Barrel
Shoe

CASING — 16 IN. 12½ IN. 10 IN. 8¼ IN. 6¼ IN. 4½ IN. 3 IN. 2 IN. — DEPTH

In at begin of shift
Put in
Pulled out
In at end of shift

Free
Sticking
Parted
Collapsed

WATER GROUND TOOLS
Struck at ..... ft | Raising | Lowering | Level | Cased off
Hard | Med. | Soft | Standing | Caving | Run in | Back up
Working, Free | Sticking | Lost | Recovered | Depth to top | Bot.
In fishing, write in details below and on back of this sheet

SAMPLING, GEOLOGY AND REMARKS.

SAMPLE: Sludge, Lit, Core — Depth
FORMATION: Cong, Clay, Schist, S. Schist, Granite, Dacite — COLOR OF SLUDGE
MINERALS: Bis Iron Ox, Red Iron Ox, Chrysocolla, Malachite, Azurite, Cuprite, Native, Chalcocite, Chalcopyrite, Pyrite
SAMPLE: Reliable, Not. Rel, Cut to, Sent Office, No Sending, Drying, In Tub

O. K. ..... Foreman O. K. ..... Sampler.

FIG. 1. FORM OF DAILY DRILL REPORT

day the management can keep in close touch with the details of the work. The reports are filed in the office on a Y. & E. "Shannon Board File," one file being used for each hole. After a hole is finished, the reports are bound together with string and filed for reference. The daily drill reports, in conjunction with the assay sheet, storehouse requisitions, and topographic map, form the basis of all records. No form is given here for the assay sheet or the storehouse requisition, as they are too simple to warrant reproduction.

Of the final records, one of the most important is the hole record shown in Fig. 2. This is made up from data obtained from the daily drill report and the assay sheet. The hole record is made on standard cross-section cloth, divided into main squares measuring 1 in. on a side. These 1-in. squares are further divided into smaller squares measuring 0.1 in. on a side. The lines on the cloth are orange colored. The hole record sheets are cut 20 in. wide and 25 in. long. This allows all relevant data for 500 ft. of hole to be placed on one sheet. The first sheet would show data from surface to 500 ft., the second sheet would show data for the depth 500 ft. to 1,000 ft. and so on.

Fig. 2 shows the proper headings for this sheet and the method of entering data. The vertical 0.1-in. subdivisions correspond to 2½ ft. of hole, one inch vertical being equal to 25 ft. The hole record gives a condensed record of the hole from top to bottom and shows at a glance all of the important information. Blueprints are made from these hole records once a month, or bi-monthly, and sent to the home office.

PREPARING CROSS-SECTIONS FROM DATA OBTAINED

Cross-sections are made up from the data obtained from the daily drill reports and from the topographic map. One set of sections should be made along the north-south co-ordinates and another set along the east-west co-ordinates. After a fair idea has been obtained of the trend of the orebody, a set of sections should be made parallel to the long axis of the orebody and another set at right angles to it. All relevant data should be plotted on these sections, the sections being drawn to a scale of 100 ft. to the inch. By connecting holes with colored lines representing different grades of ore, much information of value and interest can be obtained.

Another map that may prove of value is a contour map of the upper and lower surfaces of commercial ore, the contours on top of the orebody being full black lines, and those of the lower surface dotted red lines. The foot-per-cent-contour map will be of aid in the planning of underground operations. On this map the holes are shown in plan. The thickness of *commercial* ore in each hole is multiplied by its average grade, the product being the foot-per-cent for that hole, and this figure

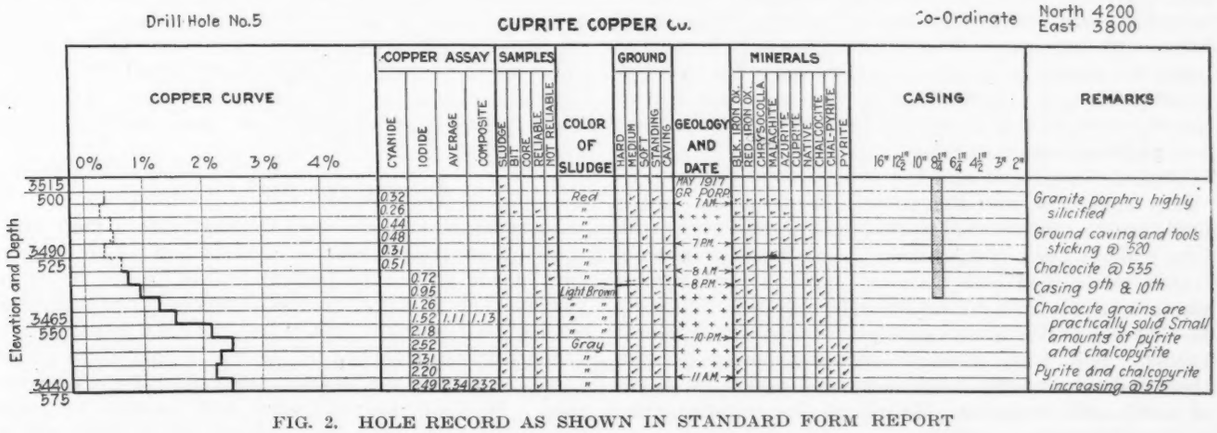

Drill Hole No.5
CUPRITE COPPER Co.
Co-Ordinate North 4200 East 3800
COPPER CURVE
0% 1% 2% 3% 4%
COPPER ASSAY: CYANIDE, IODIDE, AVERAGE, COMPOSITE
SAMPLES: SLUDGE, BIT, CORE, RELIABLE, NOT RELIABLE
COLOR OF SLUDGE
GROUND: HARD, MEDIUM, SOFT, STANDING, CAVING
GEOLOGY AND DATE
MINERALS: BLK. IRON OX., RED IRON OX., CHRYSOCOLLA, MALACHITE, AZURITE, CUPRITE, NATIVE, CHALCOCITE, CHAL-PYRITE, PYRITE
CASING: 16" 12½" 10" 8¼" 6¼" 4½" 3" 2"
REMARKS
Elevation and Depth
3515 500
3490 525
3465 550
3440 575
0.32 0.26 0.44 0.48 0.31 0.51 0.72 0.95 1.26 1.52 1.11 1.13 2.18 2.52 2.31 2.20 2.49 2.34 2.32
Red
Light Brown
Gray
MAY 1917 GR. PORP.
7 A.M.
7 P.M.
8 A.M.
8 P.M.
10 P.M.
11 A.M.
Granite porphry highly silicified
Ground caving and tools sticking @ 520
Chalcocite @ 535
Casing 9th & 10th
Chalcocite grains are practically solid Small amounts of pyrite and chalcopyrite
Pyrite and chalcopyrite increasing @ 575

FIG. 2. HOLE RECORD AS SHOWN IN STANDARD FORM REPORT

is written in at the location of the hole; i.e., at the co-ordinate intersections. Then equal foot-per-cent points are connected by contour lines, intermediate contours being interpolated as in the making of a topographic map. The ridges, as represented by the contours, will represent those portions of the orebody having the greater commercial value.

While the drill is operating in nearly barren capping

the slop-cyanide method is sufficiently accurate. When the slop-cyanide assays show that 0.75 per cent of copper is present, or when a hole enters the chalcocite zone, a more accurate method should be employed. In the earlier stages of development the laboratory will not be equipped for making determinations by the electrolytic method, so some other process must be employed. Some operators use the permanganate, though others use the iodide. I prefer the latter.

The following iodide method does not seem to be known as well as it should be, especially among the younger engineers, and I therefore give it in detail: The sample is ground, preferably by means of a disk grinder, so it will pass a 100-mesh screen. Assays are made in duplicate, and these should check to within 0.04 per cent on a 2 per cent ore, the average of the two assays being taken as the final result. If assays do not check to within the above limits, they should be re-run.

Iodide Method of Copper Analysis

Weigh out 3 g. for assay and put in a tall, 250-c.c. Pyrex beaker. Add 10 c.c. of nitric acid and 5 c.c. of hydrochloric acid and digest on a hot plate at a gentle heat until 4 or 5 c.c. of acid remains. Add 7 c.c. of concentrated sulphuric acid and take down to heavy white fumes. Cool, add about 150 c.c. of water and heat gently until all of the iron is in solution, this being told by the color of the solution and the appearance of the insoluble. Filter into a 500-c.c. beaker, washing well with hot water and make the filtrate up to about 350 c.c. Heat to boiling and from a 10-c.c. pipette slowly add a concentrated solution of sodium hyposulphite. At first a white precipitate begins to form and, on the further addition of hypo, turns brown and finally black. The black precipitate is copper sulphide.

After the black precipitate has begun to form, add 2 c.c. to 3 c.c. of hypo in excess. The reason for adding the hypo in the manner described is that if a large excess of hypo is added considerable sulphur will be precipitated. This sulphur makes a bulky precipitate, and will later have to be burned off. Boil until the solution is clear and filter through a 9-cm. filter paper. Wash with hot water. The beaker can easily be washed clean by means of a jet from the wash bottle. Put filter paper and precipitate in a clay annealing cup or porcelain crucible, dry, and ignite at a red heat—either in a muffle or over a Dangler lamp—until the filter paper is entirely consumed and the copper sulphide is practically converted into the oxide. Transfer the copper oxide into a 250-c.c. tall form beaker, or, better still, into a 6-oz. Lows copper flask. Add 3 c.c. of concentrated nitric acid and dissolve. Add 5 c.c. bromine water and boil until all bromine is expelled. Make up to 100 c.c. with water and add ammonia in slight excess. Boil until odor of ammonia becomes faint, then make acid with acetic acid and add 4 or 5 c.c. of acetic acid in excess. Boil for a few minutes, then cool and finish in usual way.

Hyposulphite solution for titration should be of such strength that 1 c.c. is equivalent to approximately 0.005 g. of copper. Assays are run on composite samples for every 25 ft. of hole, the composite sample being made from the pulp of five regular samples. This serves to further check the regular assays. The management should check the assayer at irregular intervals by sending random samples to some independent assayer.

The only engineering that is required during the course of drilling is ordinary surveying and the laying out of roads. Roads should be laid out with a maximum grade of 15 per cent, as this has been found to be about the maximum for the economic handling of supplies. A Brunton pocket transit is a most efficient instrument for road work, and one should be on the job at all times. If a topographic map has been made of the area to be drilled, the most suitable location for roads can be obtained from the map and then laid out in the field with the Brunton.

Simplified Road Surveying

More often such a map is not available, and roads have to be laid out by cut and try. That is, a preliminary location is made, and if this is not satisfactory others should be tried until the proper location is secured. The best way to do this is as follows: Begin at the point from which it is desired to start the road and estimate the probable length and the difference in elevation between the starting and finishing points. Difference in elevation divided by length of the road is the tangent of the grade angle. If starting and finishing points are visible from each other, the grade angle may be obtained direct. Set the grade angle on the vertical arc of the Brunton. Find the point on the rodman's body, neck, face, or hat that corresponds to the height of the eyes of the instrument man. The rodman is then sent ahead as far as the instrument man can see him or to a point where a radical change in alignment takes place. He is motioned up or down the hill until the part of his body that is equal in height to the instrument man's eyes is on the line of sight of the Brunton, the Brunton being held so as to indicate the proposed grade. Then the point the rodman is standing on is on grade with respect to the point on which the instrument man is standing.

The instrument man then moves to the position occupied by the rodman, the rodman moves ahead, and the operation is repeated until the trial location has been run. If the first location is not correct, the grade angle is corrected by an estimated amount and the line re-run backward, by which operation the work will usually be found to be practically correct. With the corrected grade angle, final location is made. This is done by the rodman moving ahead about 20 ft. at a time and driving a stake on grade at each 20-ft. point. These stakes show the road crew the road location and grade points.

Digging the Road to Grade

In construction, the road foreman has a man dig a trench measuring about 1 ft. wide and 18 in. long at each grade stake, the bottom of the trench being on grade. The bottoms of these trenches are connected with a trail about a foot wide, the trail being put to grade between trenches by the eye. This gives a trail corresponding to the location and grade of the proposed road. Most of the road work will be done by hand, though in some instances a plow and scraper can be used.

In hand work, the road should be divided into 25- or 30-ft. sections and one man put on each section. This allows the foreman to gage individual ability and also increases the efficiency, for a man will do more work when by himself than when in a gang. In hard ground expense can be lowered by putting in holes along the bank with a bull pick and blasting. The road crew should be supplied with plenty of sharp picks and good

shovels. Roads should be 9 ft. wide in the solid on the straightaway and wider on the turns. They should also be higher on the outside, so that the drill, as it is moved along the road, will hug the bank. Drill locations should be made wide enough to allow a 14-ft. platform and long enough to accommodate the machine and platform. Machines should be backed into the location, so that tools and casing will come into the front end of the rig.

Triangulation System of Considerable Benefit

Of great aid in operations is a triangulation system and a topographic map. The installation and making of these should be started as soon as it is seen that the drilling is going to extend over any considerable period. This work can be done by the engineer as he can spare time from his other duties. The important thing is to start both in the proper way, so that this work will be of permanent value.

For a good type of triangulation station, see "Construction of Triangulation Stations," by E. R. Rice, *Mining and Scientific Press*, Nov. 23, 1912. A base line at least 1,000 ft. long should be laid out, correct to 1 in 25,000. The meridian should be determined correct to within 10 seconds of arc. A triangulation system should be laid out in quadrilaterals, which should be adjusted by the method given in Johnson's "Theory and Practice of Surveying," pp. 549-553, sixteenth edition. Angles may be determined to any degree of accuracy, although if they are correct to within 5 seconds of arc they will be sufficiently accurate for this purpose. In using the ordinary transit, angles are best determined by the repetition method, which consists of adding the angle on the plate from four to ten times, half of the readings being taken with the telescope erect and half with it inverted. In practice the interior angle is repeated a certain number of times, as described, reading in one direction. The exterior angle is then repeated the same number of times in the same direction. Then the sums of the interior and exterior angles should equal 360 deg. The difference between the sums of the angles and 360 deg. should be applied equally to each angle. Lines of levels should be run around each quadrilateral so as to form closed circuits and the errors balanced in proportion to the lengths of the lines. Elevations should be referred to mean sea level if it is possible to connect with a U. S. Geological Survey bench mark. If no bench mark is available, datum must be assumed.

Stadia Used in Obtaining Topography

In the field work for the construction of the topographic map, topography should be done with transit and stadia, setting the transit over some known point and taking shots on controlling points such as ridges, gulches, and breaks of slope. As topography will generally be obtained when the engineer has no other duties to perform, it will be done piecemeal by the engineer and one assistant. Notes are reduced in the office by means of stadia slide rule and plotted.

The map should be of the best quality, heavy cloth-backed paper. Scale should be 1 in. equals 100 ft., and the contour interval should be 10 ft. Instead of ruling the map into 100-ft. squares with ink, it is ruled into 200-ft. squares with light pencil lines, these lines corresponding to the drill co-ordinates. At each co-ordinate intersection a small cross is made with yellow ink and then the pencil lines are erased.

Tonnages are of two kinds, total tonnage and minable tonnage. Of prime influence on tonnage is the lowest-grade ore that may be worked at a profit. This is in turn influenced by the size, shape, and mineralogical composition of the orebody.

Inasmuch as disseminated copper deposits gradually decrease in value with depth, and also horizontally away from the main ore occurrence, any change in the grade of ore that may be worked at a profit will affect the tonnage. There will be portions of the deposit, especially along the edges, that may be above commercial grade, but, owing to their irregularity of outline, or their thinness, it may not be commercially feasible to extract them. Conversely, there may be portions below commercial grade that it will pay to mine owing to a great deal of dead work having already been done near them for the purpose of mining higher-grade ore, which higher-grade ore has carried the expense of the deadwork.

Calculation of Total Tonnage

Assuming that it has been decided, after a study of the subject, that 1.3 per cent is the lower limit of commercial ore, the orebody is divided into blocks, 200 ft. square, with drill holes at the corners of each block. Suppose the hole at one corner of a block has the following assay log through the horizon of commercial ore, zero depth being at the top of the orebody:

Depth, Ft.	Assay, Per Cent Cu	Depth, Ft.	Assay, Per Cent Cu
0–5	0.27	65–70	1.81
5–10	0.58	70–75	1.55
10–15	0.90	75–80	1.48
15–20	1.22	80–85	1.58
20–25	1.62	85–90	1.38
25–30	2.02	90–95	1.25
30–35	2.27	95–100	1.38
35–40	2.38	100–105	1.40
40–45	2.42	105–110	1.32
45–50	2.13	110–115	1.27
50–55	1.80	115–120	1.20
55–60	1.72	120–125	1.15
60–65	1.60	.....	....

From a depth of 20 ft. to a depth of 110 ft. there is 90 ft. of ore averaging 1.73 per cent. In the example given, ore above 1.3 per cent extends from the 20–25 sample, running 1.62 per cent, to the 105–110 sample, running 1.32 per cent, excepting the 90–95 sample, running 1.25 per cent. The 90–95 sample, though below the minimum grade, occurs 15 ft. above ore running sufficiently over minimum grade to make the entire 20 ft. above minimum grade.

The foot-per-cent of this hole would be 90×1.73, which equals 155.7. Suppose the other three holes at the remaining corners of the block show 80 ft. of 1.62 per cent ore, 110 ft. of 1.92 per cent and 85 ft. of 1.62 per cent copper. The foot-percentages of these holes would be 129.6, 211.2, and 137.7 respectively. The sum of the four foot-percentages would be 634.2. The sum of the individual thicknesses of ore in each hole would be 365 ft. The average grade of the block would be 634.2 divided by 365, which is equal to 1.73 per cent. The average thickness of the ore in the block would be 365 divided by 4, which is equal to 91.2 ft. Therefore the block contains an orebody that averages 1.73 per cent copper, the dimensions of the orebody being 200 ft. square and 91.2 ft. thick. Ore of the class under discussion has been assumed in many instances to be of such specific gravity that 12½ cu.ft. weighs one ton. Using the factor of 12½ cu.ft. to the ton, the tonnage of the block would be 291,000 tons of 1.73 per cent ore.

Each individual block is treated in a like manner. Then the tonnage of each block is multiplied by the

grade of ore of the block, giving the ton-per-cent for that block. Such factors calculated for all blocks are added together, giving total ton-per-cent for the entire deposit. Total ton-per-cent divided by total tonnage gives the average grade for the deposit.

No ore is regarded as fully developed unless blocked out by holes at all four corners of a square. With holes at three corners of a square, the ore in one-half the block is figured as probable. Possible ore is figured beyond existing holes from a study of the geology of the deposit, the cross-sections of the orebody, and the occurrence of the ore in the nearest holes.

Available Ore Determines Mining Method

Minable tonnage is of more importance than the total tonnage and is harder to compute. This is due to the fact that fluctuations in price of finished product, cost of mining, cost of concentration, concentration losses, and applicability of mining methods to the form of the deposit must be taken into consideration. The sections and foot-per-cent contour map mentioned under records will be of great aid in this connection. After studies have been made of the orebody and of mining methods employed by companies mining similar orebodies, a mining method may be tentatively decided upon. When this has been done, and costs of mining by this method have been estimated, one is in a position to estimate what portions of the orebody are minable at a profit. This having been determined, the calculation of minable tonnage becomes quite a simple matter.

Though the following remarks have nothing to do with actual exploration, they may be regarded as being of interest to the subject of mine development.

Advisable To Secure Sufficient Ground at Beginning

When it is seen that there is a probability of developing a commercial orebody, options should be taken on all the ground that is likely to be needed by the company, both mineral and non-mineral. A great deal of ground is needed in the exploitation of a disseminated copper deposit, and the best time to get the necessary territory is at the inception of operations when the pioneer operator is the only one who has reliable information as to ore occurrence and future possibilities. Nature does things on a grand scale, and when mineralization has been intense enough to form one large orebody it is safe to conclude that more than one orebody has been formed in the same zone of mineralization. Any of the important copper camps will confirm the accuracy of this statement.

Most of the important porphyry mines now own considerable territory, although many of these holdings have been acquired by a purchase of the holdings of other companies or by consolidation. Rarely does one find an instance where the pioneer company has had the foresight to buy up large acreages from the original claim owners.

All mining claims should be taken to patent as soon as possible, as such a step eliminates possibility of subsequent litigation.

Drilling should be done in supposedly barren formations to prove that these formations are non-mineral, and also for the purpose of being able to locate the main shaft and the concentrator at points where they will not be endangered by subsequent caving of ground due to mining operations.

Safety Cutout for Trolley Wires At Loading Chutes

By E. D. Gardner*

Trolley lines used in connection with electric haulage in mines are a source of danger, and many lives have been lost by men accidentally coming in contact with the wires. Usually the wires in metal mines are sufficiently guarded to prevent men from touching them with their person or by pieces of steel which they may be carrying on their shoulders while walking along the level. However, it is difficult to guard effectively the wires at loading chutes along the haulageways, and despite safeguards, chute trammers have been electrocuted through loading bars that accidentally touched the trolley line.

To overcome this danger the Calumet & Arizona Mining Co. formerly used a hinged V-shaped trough made of 1-in. x 6-in. lumber, that was dropped over the wire in front of the chute, when the cars were being loaded. This arrangement interfered with the easy operation of the chute, and a cutout device for the trolley line was devised. This cutout is efficient, easily constructed, and does not interfere with the operations at the chutes or with the motors operating on the same level.

When the cutout is open the electric current is carried past the gap by an insulated wire on the opposite side of the drift. A hinged board drops down over the ends of the trolley guard when the slide is open and prevents anything touching the live wires.

The cutout is simple in construction and consists essentially of a section of ¼-in. rod that slides back into a 6-ft. length of ½-in. pipe, both of which are a part of the trolley line. When closed, one end of the rod remains in the long pipe, at the set back of the chute, and the other end fits into a 6-in. length on the set ahead, and both ends have enough bearing to make proper electrical contact. Standard electric equipment is used in the mine, and as the trolley-wire hangers will not fit the ½-in. pipe, a ¼-in. rod is welded on top for clamping it in place. The motors run past the cutouts with no interference.

When the cutout is closed, it is guarded by two ½-in. x 6-in. boards, as elsewhere. The free end of the rod and guard boards are fastened together by an open rectangular piece of ½-in. x 3-in. iron. The trolley rod is hung from the top of the iron by insulated hangers, and the guard boards are bolted to the sides. The boards slide back in brackets outside of the regular guards. Occasionally, in wet places, enough current leaks through the insulators to the boards of the cutout to shock a man, and, to prevent this, insulated knobs are placed on both guard boards for handling.

Silver Deposits in the Philippine Islands

According to a statement in *Philippine Resources and Opportunities*, silver in the Philippine Islands, in most instances, is found in a ratio of 1 to 4 alloyed with gold. Silver deposits are found in Bulacan, Paracale, Cebu, Marinduque, and Mindanao. No extensive attempt has been made to develop the silver mines, which, according to authority, can be advantageously worked on a commerical basis. The establishment of a local mint would serve to stimulate the interest in the mining of this metal in the islands. Both China and India are on a silver-standard basis, thus assuring a near-by market for Philippine silver.

*In *Reports of Investigations*, U. S. Bureau of Mines.

Mining Engineers of Note

L. D. Anderson

THE earliest recollection of the subject of this sketch is that of being pulled by the heels from beneath a switch engine under which he had crawled to find out how the Stephenson link motion made the engine run backward. Fortunately an indulgent parent did not allow his wrath to overcome his appreciation of the fact that an avidity for mechanical knowledge might be put to some good use. Born of Swedish parents in Ishpeming, Mich., Mr. Anderson's early education was of the normal American type gained in the public grade and high schools of that place, followed by four years of study in mechanical engineering in the University of Michigan, at Ann Arbor. His first professional engagement after graduation was as a helper in the shops of the Nordberg Manufacturing Co. at Milwaukee. Later came a promotion to the drafting room. After this Mr. Anderson spent a year in the engineering offices of the Bucyrus Co., of South Milwaukee, Wis., specializing in the design of steam shovels, pile drivers, and wrecking cranes. It is not generally realized that the rough-looking steam shovel is a triumph of engineering design. Deep interest was attached to making the drawings of the first fifty shovels for digging the Panama Canal.

L. D. ANDERSON

A year as mechanical engineer for the Champion Copper Co. at Painesdale, Mich., brought a more intimate contact with mining. Under the initiative of its chief engineer, F. W. O'Neil, many innovations were introduced to the Michigan copper country, such as the cross-compound steam stamp and the Nordberg quadruple expansion, two-stage air compressor, which broke all world's records for economy. Although the cross-compound stamp has been replaced by the steeple compound, it was the pioneer in compounding. After completing the work at this place another year was spent in the engineering offices of the Bucyrus Co.

Through the recommendation of Mr. O'Neil, Mr. Anderson was sent out to Humboldt, Ariz., as construction engineer for the Arizona Smelting Co. With this engagement began a real and permanent connection with mining and smelting. The experiences at this plant were interesting in the extreme, involving the effort to make a success of many novelties, things which were in fact too novel. It was attempted, for example, to launder reverberatory slag five hundred feet to a river bank, keeping it hot and liquid en route with oil flames. Needless to say, the attempt was a failure. After the construction work on this plant had been completed, Mr. Anderson became assistant to C. F. Moore. chief engineer of the United States Smelting, Refining & Mining Co. About six years of extraordinarily varied engineering work in all lines of mining and smelting were followed by the superintendency of the Midvale smelter of that company. This work was taken up with some trepidation, representing apparently metallurgical rather than engineering practice. It was soon found, however, that neither field was independent of the other; that in fact good metallurgy meant the application of good engineering. During the incumbency of this position a number of effective improvements were worked out. Among these was the invention of a new method of charging lead blast furnaces. When this was put into operation about sixty charge wheelers were laid off. Mechanically accurate charging, in addition to cutting labor cost, improved the metallurgical recovery. The plant was fortunate in having able technical men on its staff during this time, and they did much meritorious work. Notable were R. H. Stevens, who invented a method for cadmium recovery from baghouse dust; J. F. Cullen, inventor of methods for making metallic arsenic, calcium arsenate, and weed killer, and assistant superintendents C. L. Colbert, Curtis Pigott, and Robert Wallace.

After two years of business work as manager of the Midvale plant, Mr. Anderson is now chief engineer of all the company's properties, with headquarters at Salt Lake City. He is a member of the American Institute of Mining and Metallurgy, the American Society of Mechanical Engineers, and the Utah Society of Engineers. He was married to Miss Mabel Cooley, of Milwaukee, Wis., in 1907. They have one daughter and two sons.

HANDY KNOWLEDGE

The Alvarado-Type Ore Skip

Written for *Engineering and Mining Journal*

The Alvarado Mining & Milling Co., operating in the Parral district, Mexico, has long used an ore skip designed on the three-point suspension principle for service in inclined shafts. No trouble has been experienced from derailment during hoisting.

The front axle of the skip is bolted securely in place, as shown in Fig. 1. The back axle consists of a single steel casting, pivoted midway and held in place by angle-iron guides. When the skip is running on an uneven track, its weight is thus distributed equally over the four wheels, wherein lies the advantage of three-point suspension. Both axles are equipped with Hyatt roller bearings.

The rear axle with the pivoted casting may be removed as a unit, when repairs are necessary, by taking out the steel pin, *C*, Fig. 1. Similarly, the front axle may be removed by taking out the four bolts shown at *D*, Fig. 1. Spare axles are kept on hand.

The accompanying illustrations show such a skip of 80-cu.ft. capacity, which is also equipped with emergency valves in the lower end, so that it can be used for bailing water in a pinch. These valves are shown at *B* in Fig. 1. When ore is being hoisted, each valve is kept closed by a washer made of pipe and held in place by a nut. When bailing is necessary, this piece of pipe is removed and a light spring substituted for it.

At the lower end of the skip, on the upper side, are three 3 x 6-in. slots, as shown at *A* in Fig. 1. Through these a bar may be inserted to clean out the clay and other sticky material which accumulates in the bottom of the skip. There is considerable clay in some of the ore handled, and this tends to pack solidly. In case the skip is used for bailing water, soft wooden plugs are driven into these slots.

Ordinarily the skip is not used for bailing, but is equipped for the purpose, as described, as an added precaution against the drowning of the pumps in case the water flow should become too heavy for the latter to handle.

Protection of Mill Ore Chutes

Written for *Engineering and Mining Journal*

The protection of ore chutes from undue wear caused by a moving stream of ore is accomplished in a variety of ways. At the flotation mill of the Calaveras Copper Co., Copperopolis, Cal., worn-out ball-mill liners are cut to size by means of the acetylene torch and used to protect the bottom of the chute. The sides of the chute are protected by iron straps which are bolted to the side boards.

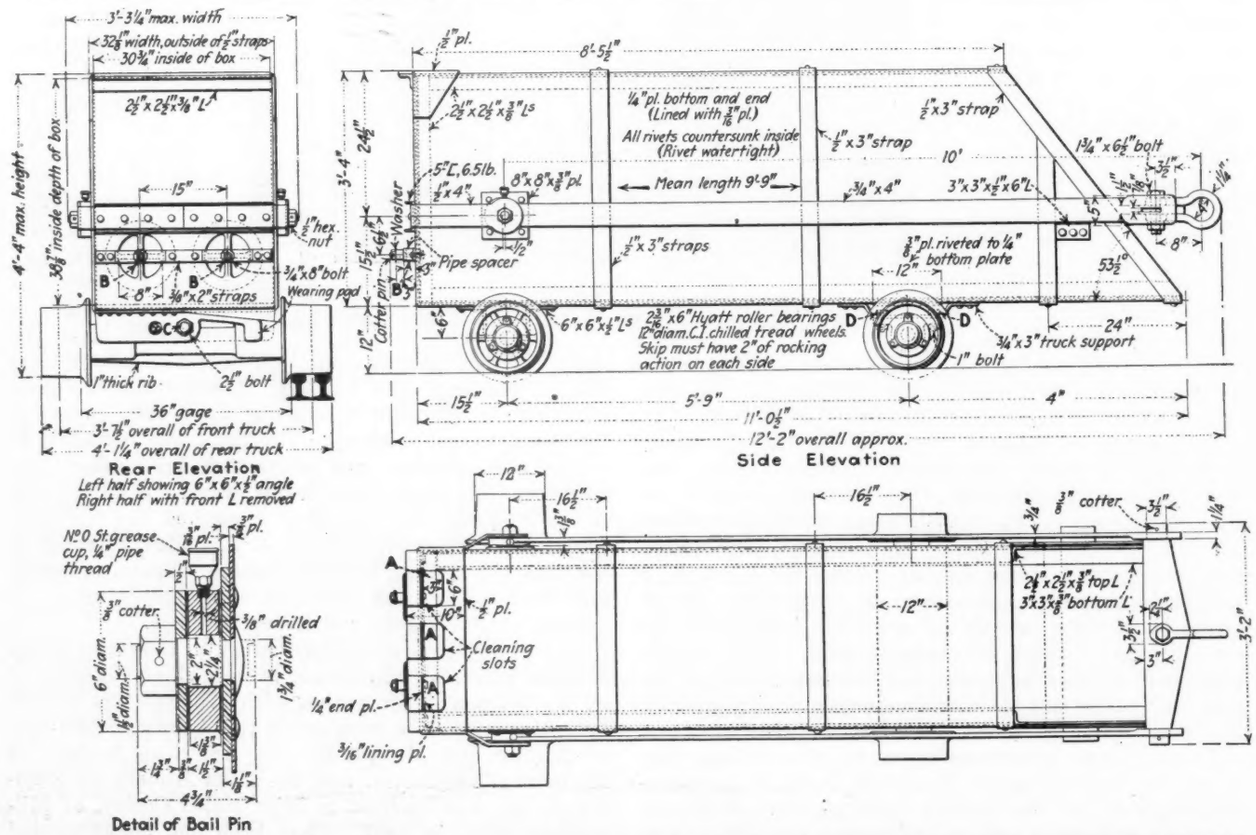


FIG. 1. DETAILS OF 80-CU.FT. ORE SKIP USED BY ALVARADO MINING & MILLING CO., PARRAL DISTRICT, MEXICO. THIS IS BUILT ON THREE-POINT SUSPENSION PRINCIPLE

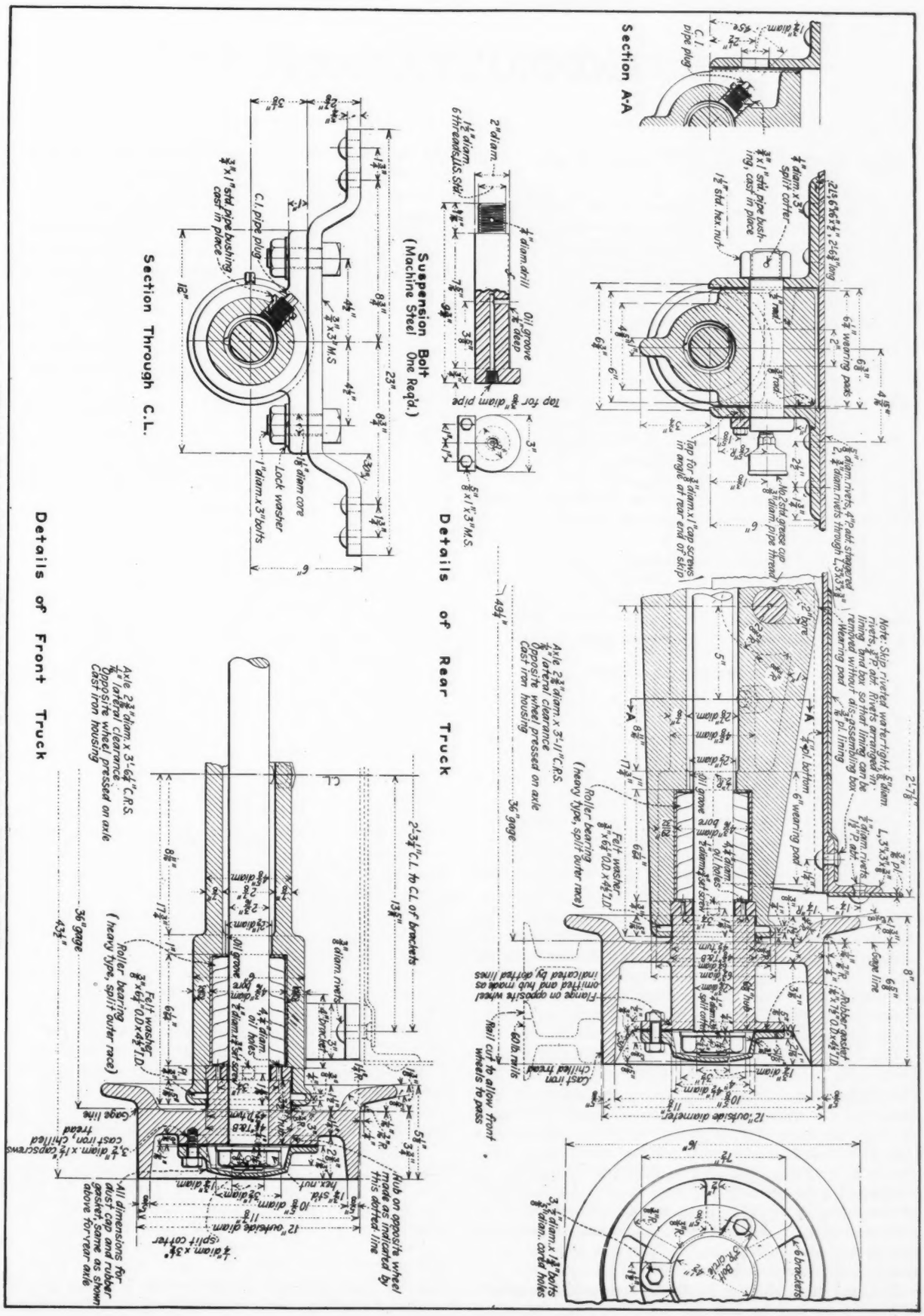

Section A-A
Suspension Bolt
(Machine Steel One Req'd.)
Section Through C.L.
Details of Front Truck
Details of Rear Truck
Note: Skip riveted watertight
Roller bearing
(heavy type, split outer race)
Rail cut to allow front wheels to pass
Cast iron Chilled Tread
Rub on opposite wheel; make as indicated by this dotted line
Axle 2¾" diam. x 3'-6¼" C.R.S.
Opposite wheel pressed on axle
Cast iron housing
Gage line
36" gage
All dimensions for dust cap and rubber gasket, same as shown above for rear axle
6 brackets

FIG. 2. DETAILS OF FRONT AND REAR TRUCKS OF ALVARADO-TYPE ORE SKIP

CONSULTATION

The South African Gold Premium

"I would like to know whether you have any data available regarding the exact significance of the so-called premium in the operations of the gold mines of the Transvaal, South Africa, and how much the cost of mining Transvaal gold has increased."

Although it is well known that the premium received by the South African gold miner is a measure of the depreciation of British paper money, and that the premium is of great help to British gold mining in South Africa, the average reader is possibly not so well informed about the exact relation between the gold premium and the profits of Transvaal mining companies, as expressed in pounds sterling.

The reports of individual South African gold-mining companies practically all bear tribute to the value of the gold premium to their operations and view the gradual improvement in sterling exchange, which amounts to a corresponding gradual extinction of the premium, with alarm.

In order to indicate the influence of additional gold revenue or premium in South African gold mining, the following table, showing comparative statements of revenue, working expenditure, and working profits of the gold mines of the Witwatersrand area, is given:

WITWATERSRAND GOLD MINES

	1919	Per Ton Milled	1920	Per Ton Milled
Tonnage milled	24,043,638	.....	24,096,277	.....
Revenue from gold won (at standard price)	£34,297,431	28.53/—	(*a*) £33,231,257	27.58/—
Working expenditure	£27,518,253	22.89/—	£30,814,861	25.57/—
Working profit (exclusive of premium)	£6,779,178	5.64/—	£2,416,396	2.01/—
Additional revenue from sales of gold above standard price	£3,503,067	2.91/—	£8,885,380	7.37/—
Total revenue	£37,800,498	31.44/—	£42,116,637	34.95/—
Working profit (inclusive of premium)	£10,282,245	8.55/—	£11,301,776	9.38/—
Dividends declared	£5,845,607	4.87/—	£8,275,708	6.87/—

(*a*) Exclusive of revenue from accumulated sands and slimes estimated on the 1919 basis at £157,000.

The table clearly shows that gold production declined slightly during the year 1920, compared with 1919, that working profit, exclusive of premium, declined greatly (due to increased cost of mining), but that additional revenue from sales of gold above the standard price of 85s. more than made up the deficiency in working profit, and swelled the total revenue figures.

The large difference between the additional revenue from sales of gold above the standard price in 1919, £3,503,070, and the sales of 1920, £8,858,380, can be accounted for partly by the widely fluctuating value of the gold premium during those two years and the fact that the premium was not realized until July, 1919. The total dividends declared in 1920 almost equaled the additional gold revenue for that year. An inspection of the table will quickly disclose the importance of the gold premium. Without this additional income the South African gold-mining industry would be in the same position as it is in the United States.

The cost of producing South African gold has greatly increased during the last six years, so that for a particular group of South African gold mines in the year 1920 it was about 47 per cent greater than the average for 1915. The report of the directors of The Central Mining & Investment Corporation, Ltd. (British), a company operating many large gold properties, contains a table supplied by H. F. Marriott, consulting engineer of the corporation, which shows the increases in costs of mining during the last six years for gold-mining companies operated by the corporation or in which it is financially interested. The table follows:

DIRECT WORKING EXPENDITURE AT THE MINES

(Exclusive of Charges Not Under the Control of the Management)

Year	Wages: European	Wages: Native	Materials	Other Costs	Total	Tons Milled
1915	4/9.6	3/10.8	5/8.3	3/2.1	17/6.8	10,405,000
1916	4/11.7	4/1.6	6/0.9	3/3.4	18/5.6	10,156,000
1917	5/7.1	3/10.6	6/4.9	3/9.3	19/7.9	9,359,000
1918	6/8.2	4/2.8	7/6.6	3/7.1	22/0.7	12,005,000
1919	7/4.6	4/2.3	7/10.3	3/11.1	23/4.3	11,267,000
1920	8/6.4	4/6.1	8/5.3	4/4.9	25/10.8	11,028,000
Month December, 1920	9/2.4	4/9.6	9/2.4	4/1.7	27/4.1	867,000

European wages have increased greatly (assuming the same ratio of wages to total costs throughout the period); native wages have increased moderately; materials show an increase of 61 per cent; other costs have advanced 39 per cent. All these costs are not, however, calculated on a metallic basis, particularly for the years 1919 and 1920, during which period the full extent of the depreciation of the pound sterling was felt and measured by the gold premium. The increase in mining costs is but a reflection of the world-wide increase in the cost of operating mines, and the table is significant in hinting what the state of affairs would be were no premium available to offset the increased charges. Incidentally, it is instructive to observe that the total cost of the European white employees, who largely act in a supervisory capacity and constitute one-eighth of the total labor force, is nearly double the whole expenditure on native laborers who carry on the work.

South African gold production has kept up remarkably well during the last five years, although it has declined. It may appear strange that an industry should capitalize on the depreciation of its government paper currency, but that is precisely the situation in South Africa. As sterling exchange improves, the profit of the gold miners decreases, and vice versa. It may well be, that before sterling exchange returns to its parity of $4.866, deflation of labor commodity prices will have progressed to such an extent that mining can be continued on a normal cost basis, in which event the gold premium will have proved a remarkable stabilizer.

"When gold falls to 100s., it will cause unemployment of 5,800 Europeans, with sixteen mines working at a loss; when gold falls to 90s., there will be 12,000 Europeans out of employment, and twenty-six mines working at a loss; when gold falls to normal, 85s., there will be 14,400 Europeans out of employment and thirty-one mines working at a loss." Although this estimate of Lord Buxton's is theoretical, it gives an indication of what the industry might expect upon a sudden return of sterling exchange to par.

THE PETROLEUM INDUSTRY

Petroleum in the Mendoza-Neuquén District, Argentina*

BY ARTHUR H. REDFIELD

Evidences of oil occur in the Province of Mendoza and the territory of Neuquén, in a belt along the eastern slope of the Andes, beginning forty miles north of Mendoza, and extending south to 42 deg. S. latitude. The area covers 6,000 square miles, of which 300 square miles show possibilities of oil; and less than one square mile has been proved.

The principal seepages in Mendoza occur at Cacheuta, in the Department of San Rafael, at the southern end of the Cordillera de Mendoza, and at Colonia Alvear, near the boundary of Neuquén, 120 miles from the terminus of the Western Argentine railway. In Neuquén, the principal deposits appear to lie in the vicinity of Plaza Huincul, between the stations Challaco and Ramon M. Castro on the Argentine Southern railroad; six miles from Zapala, the western terminus of the Southern railroad; at Cerro Lotena, in the southern part of the territory; and along the Rio Barrancas, sixteen miles from its confluence with the Rio Grande.

The primary oil horizon of the Mendoza district is found in the San Rafael shales and sandstones, Kimmeridge-Portlandian series (Upper Jurassic). Secondary enrichments occur in the variegated sandstones (areniscas abigarradas) of the Upper Cretaceous. The parent formation is in all probability the bituminous shales of the Rhaetic (Upper Triassic). The petroliferous formation of the Neuquén district is the marl complex of the Kimmeridge-Portlandian (Upper Jurassic) grading into the Upper Tithonian (Upper Jurassic) limestones. As in the Mendoza district, secondary deposits are found in the Upper Cretaceous sandstones.

The structure in the Mendoza district is that of an elongated flat anticline, whose axis runs generally northeast-southwest. This anticline is continued in the Neuquén district to the south. The petroliferous character of the Mendoza district is evidenced by numerous seeps of oil and exudations of semi-solid asphalt (rafaelite). Similar indications are found in the Neuquén district.

The Mendoza district was surveyed in 1886 by Dr. Züber, and exploitation soon followed. The Compañía Mendocina de Petróleo drilled in this field from 1886 to 1897, without notable results. In 1910 the Argentine Western Syndicate drilled three wells, and the Cacheuta Oil Syndicate drilled two. Shows of oil were obtained. Active development ceased in 1915. The greatest output ever obtained did not exceed 12½ bbl. a day. The petroleum encountered is a paraffine-base oil containing 4 per cent of light oils and 23 per cent of illuminants.

Efforts prior to 1915 by the Acme Syndicate and by local operators by means of shallow pits produced no results in the Neuquén district. Borings by the Argentine government begun in 1916 proved successful in 1918. A paraffine-base oil containing 25 per cent of naphtha and 35 per cent of kerosene was found in commercial quantities.

*U. S. Geological Survey, Section of Foreign Mineral Resources.

Pouce Coupé District Promises Activity

SPECIAL CORRESPONDENCE

Preparations for the exploratory work of the Imperial Oil Co. in the Pouce Coupé district of eastern British Columbia, practically on the border of this province and the province of Alberta, are well under way. Wet weather at the beginning of May interfered with the work of transporting plant and supplies, but since then conditions have improved. All the equipment and the casing necessary for the first well, however, is on the ground.

An unusually heavy outfit is being used for the first well. It drills a 21-in. hole, and is capable of going to a depth of 4,000 ft. The hole is being sunk near one of the seepages. The most promising of these is at the junction of Tepee Creek and the Pouce Coupé River. Oil, it is stated by geologists, is most likely to be found either at a depth of 700 ft. or of 3,300 ft.

Negotiations are said to be in progress for the purchase of 200 sections of land in the district by Eastern capitalists, and it is probable that between fifteen and twenty drills will be operating in the field within the next two or three months.

Oil and Gas Drilling in Arkansas

SPECIAL CORRESPONDENCE

The Walbert Oil Co., Batesville, Ark., has started the erection of a derrick for an oil and gas test on a block of 6,000 acres, recently leased in Township 12, five miles west of Batesville. A Keystone No. 32 rig has been shipped, and work will start on the test as soon as it arrives. The company is composed of local men, who will give their ground a thorough test. The well is being sunk near a water well drilled a number of years ago, which has produced a small flow of gas since that time. The ground has been favorably reported upon by two geologists, who say that it is possible that gas and oil will be encountered in three sands—one at 800 ft., another at 1,100, and a third at 1,700 ft.

A derrick has been completed for Cave City No. 1 well, at Cave City, fifteen miles east of Batesville, on the Independence-Sharp County line. Standard tools will be used in making this test. The drilling contract with the Big Six Drilling Co. calls for a hole 2,000 ft. deep, with an option of going deeper.

Oil-Well Machinery Exports in May

WASHINGTON CORRESPONDENCE

Exports of mining machinery increased during May, as compared with exports of May, 1920. In May of this year, exports of oil-well machinery were valued at $1,039,667. Exports of other types of mining machinery were valued at $688,326. In May, 1920, exports of oil-well machinery were valued at $504,085. Other mining machinery exports were valued at $630,975.

There was a decrease in the value of exports of pumps and pumping machinery. In May of this year, the value of the exports of this type of machinery was $743,498. In May of 1920 exports were valued at $1,155,128.

Technical Papers

Pyrometry—All who use pyrometers or conduct high-temperature operations will be interested in the latest publication of the U. S. Bureau of Standards, Bulletin No. 170, entitled "Pyrometric Practice" (326 pages, obtainable on request to the Bureau at Washington, D.C., for a limited time, or for 60c. from the Superintendent of Documents, Washington, D. C.). The bulletin is a complete treatise embracing not only the theory of design of modern American instruments but discussing their practical application and standardization.

Nova Scotia Mines—The Annual Report on Mines, 1920, by the Nova Scotia Department of Public Works and Mines, Halifax, N. S., is at hand. (103 pages, obtainable on request). The chief products were coal, iron, limestone and dolomite, and gypsum.

Yukon—Memoir 123, sixty pages with maps, of the Canadian Geological Survey, Ottawa, Ont., describes the Sixty-mile and Ladue Rivers Area, in the Yukon. The geology of the region and the placer gold deposits are discussed. The bulletin may be obtained on request.

Salt in Nova Scotia—Memoir 121 of the Canadian Geological Survey, Ottawa, Ont., obtainable on request, describes the Malagash salt deposit in Cumberland County, N. S. The salt occurs as a stratified deposit interbedded with rocks of the Mississippian period.

British Columbia Minerals—Memoir 118 of the Canadian Geological Survey, Ottawa, Ont. (129 pages, obtainable on request to the Survey), describes the various mineral occurrences between Lillooet and Prince George, B. C. Besides giving the general geological features of the region, separate chapters are devoted to hydromagnesite and calcareous tufa; epsomite and sodium carbonate; clay; diatomaceous earth, lignite, peridot and mica; chromite, molybdenite, manganese and nickel; and gold, silver, copper, and lead.

Accidents—Technical Paper 286 of the U. S. Bureau of Mines, Washington, D. C., ninety-seven pages, is largely of a statistical nature and is devoted to metal-mine accidents in the United States during 1919, with supplemental labor and accident tables for 1911 to 1919 inclusive. Obtainable for a time free from the Bureau or from the Superintendent of Documents, Washington, D. C., for 10c.

Queensland Geology — The Queensland Geological Survey, Brisbane, has issued Publication No. 265, forty-eight pages, with numerous illustrations and maps, describing mining operations and geological conditions in the Cloncurry-Camooweal-Burketown-Boulia area of northwestern Queensland.

Petroleum—"Underground Conditions in Oil Fields," by A. W. Ambrose, has been issued as Bulletin 195, Petroleum Technology 62, by the U. S. Bureau of Mines. This bulletin points out general methods of procedure in studying the various factors met in oil exploitation, including the solution of water problems and the preparation of cross-sections. Obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 65c., or for a time free of charge from the U. S. Bureau of Mines.

Petroleum in Alaska—Bulletin 71 A, issued by the U. S. Geological Survey, "Preliminary Report on Petroleum in Alaska," has been prepared by George C. Martin. Petroleum indications are confined to five districts, only one of which, the Katalla field, is producing. The report covers location, development, geology, and occurrence and production of petroleum in each of the districts. Copies may be obtained from the Superintendent of Documents, Washington, D. C., at 50c. each, or, for a time, free from the U. S. Geological Survey.

Western Crude Oil—"Properties of Typical Crude Oils From the Producing Fields of the Rocky Mountain District" is the title of the U. S. Bureau of Mines *Reports of Investigations* No. 2,235. It is a mimeographed paper of fifty pages, and may be obtained on request to the Bureau at Washington, D. C. Analyses and tests are given of oils from Wyoming, Colorado, and Montana, with laboratory figures for typical samples from several other producing fields for purposes of comparison. This supplements Report No. 2,202, issued in January, 1921, which described oils from the Eastern producing fields.

Helium — "Helium-Bearing Natural Gas" is the title of U. S. Geological Survey Professional Paper 121, 113 pages, obtainable upon request to the Survey, Washington, D. C., free of charge for a limited time, or from the Superintendent of Documents, Washington, D. C., for 30c. Helium is extremely useful for inflating balloons and Zeppelins, for it has 93 per cent of the lifting power of hydrogen and is not combustible, as is hydrogen. This paper is an exhaustive treatise on the subject.

Diamond Drilling—In the April issue of *Mine and Quarry* (Sullivan Machinery Co., Chicago, Ill.) appears an article, "The Romance of the Diamond Drill," which is the second chapter of a series, "Fifty Years of Rock Cutting Tools." The article covers the history and use of diamond drills in prospecting, with particular emphasis on the work done in South Africa.

The Federal Reserve System—A seventy-page booklet descriptive of our national banking system, entitled "The 'Why' of the Federal Reserve," has been published by R. H. MacMasters & Co., 82 Broad St., New York City, and is presumably obtainable upon request.

Book Reviews

The Tin Resources of the British Empire. By N. M. Penzer. Cloth; 5½ x 9; pp. 358. William Rider & Son, Ltd., London; 1921. Price, 15 shillings, net.

This is a book in the "political and commercial geology" field. The war has stimulated interest in this new branch of economic science. Following the publication of "Political and Commercial Geology," edited by J. E. Spurr, and the atlas on "Commercial Geology," issued by the U. S. Geological Survey, there have appeared a number of brief memoirs of the Imperial Institute of Great Britain, each covering some economically important metal or mineral, and modeled on the same plan as the chapters of "Political and Commercial Geology." A similar series of world studies on the political and commercial aspect of the distribution of important mineral supplies, and again on the same plan, is also now appearing in France in the *Revue des Mines*. It is safe to say that the permanent foundation for a new branch of political science is being laid in the work covered in these publications.

This book on "The Tin Resources of the British Empire" is a more elaborate treatment of one of the key metals economically. The general introduction states the economic purpose plainly: "One of the great problems of the day is the development of the British Empire's industrial resources, *and unless full and detailed information is obtainable on such important raw materials as tin it is ludicrous for statesmen to attempt to formulate an economic policy.*" The italicized statement is a true one for any country and for the world, and a realization of the principle set forth is of major importance at this time.

The restriction of the treatment of the subject of the commercial geology of tin to the British Empire is, of course, a frank viewing of this important economic field from the standpoint of British nationalism. Of this we cannot but approve; it is the simple one from either the British or the American standpoint. It is the necessary step toward greater intelligence, peace, and prosperity.

The execution of the book seems careful and reliable. It should be in the library of any student of political and commercial geology. The tin resources of the British possessions in the five great continental areas—Europe, Asia, Africa, America and Australasia—are treated by colonies, and this is followed by chapters on the uses of tin, prices and output, and a bibliography. Under each continent the subject is treated geographically, and in each district the geography, geology, winning, data of commercial control, economic factors, production, and other essential features are woven together in one narrative.

J. E. S.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Long-Flooded Timbered Metal Mines Form an Unusual Hazard*

Recent Reports Indicate Distinct Danger From Methane in Reopening Old Shafts

Though metal mining is at a low ebb, there is, especially in the West, a well-defined movement toward reopening long-abandoned mines with intent to extract ores of a grade formerly rejected but probably amenable to present-day methods of treatment. Many of these properties have long been under water, and their recovery presents, according to D. Harrington, the danger of the possible occurrence of methane.

On April 21, 1921, an explosion of gas, severely burning the two workmen present, occurred in an adit near Black Hawk, Col., the morning after a hole had been opened into a timbered flooded shaft which had been under water for more than twenty-five years. The adit had been driven from the surface on the mountain side about 1,400 ft., partly in a quartz vein, partly through granite country rock, had intersected no strata containing gas or carbonaceous material, and had encountered no gas of any kind until within a short distance of the shaft. Then water started to come into the tunnel from back and floor, bringing with it a gas having a musty odor. The gas gave the men headache, but was not ignited by and did not extinguish the flame of a carbide lamp. The shaft was intersected at a point about 400 ft. below the shaft collar. Some account of the accident was given in *Engineering and Mining Journal* for May 7, 1921, p. 802.

Presumably the gas carried into the adit by the water escaping from the shaft had been pocketed in the region above the level of the hole into the shaft. When the place was inspected two days after the explosion, using safety lamps (the adit had not been entered since the explosion), it was found that air circulation had been established through the adit and up the shaft, and no afterdamp and no methane could be found in the adit, so that it was impossible to obtain samples, nor could any samples be taken in the shaft, as it was inaccessible.

The occurrence parallels one observed near Butte, Mont., in 1917. A timbered vertical shaft 1,000 ft. deep had been filled with water and silt for about nine years, and when it was reopened, gas which burned was met just above the 500-ft. shaft station. The gas would bubble out of the water and mud on the floor and in presence of an open flame would ignite along the sides of the timbers. Notwithstanding the installing of electric lights, one morning after several hours' cessation of work at the bottom of the shaft the men went down with open carbide lights, and a small explosion occurred at the bottom. The men were badly shaken up, but not injured. Later two samples of gas were obtained from a point close to the water on the floor of the shaft, while the watery mud was being loosened by a shovel. The analyses showed that both samples were relatively high in CO_2 and both contained methane, thus definitely establishing the identity of the gas causing the ignitions.

These gas samples were taken when the shaft had been recovered to a point about 580 ft. below the collar. As the work proceeded, care was taken against use of open lights; the men noticed much bubbling of gas when they approached the 800 shaft station and again when about 50 ft. above the 1,000 shaft station. Also, it was noticed that immediately after copious bubbling of gas through the water on the floor, the water would disappear, presumably taking the place vacated by the gas as the latter was released by lessened pressure above it, with progressive removal of silt and water.

When the working bottom was about 30 ft. above the 1,000 shaft station, three men were at work on the bottom using closed lights and wearing rubber garments, as there was a copious flow of water down the shaft and on the floor. The night foreman, with a naked flame, was being lowered on the cage, when his light ignited gas just below the 800 level. The foreman on the cage was burned severely, and notwithstanding the copious flow of water in the shaft, the flame extended down 170 ft. to the bottom where the three men were working. All three were severely burned about face and hands, and they, as well as the foreman, had to spend some weeks in the hospital. It is remarkable that the four men were not severely injured by flying objects, as the concussion tore out lagging, broke pipe, ventilation partitions, and other fittings.

In the above-related occurrence it was definitely established by analysis that methane was present. There is no reason to doubt that this methane was formed by the decomposition of timber under water, in a manner somewhat similar to the formation of methane in swamps and from which methane takes its name, marsh gas. The shaft was wholly in granitic material, as was the shaft at Black Hawk, Col. There was no record or knowledge of intersection with carbonaceous shale or other strata bearing explosive gas, and in both cases there were no known oil- or coal-bearing strata within miles. Both shafts were timbered and both had been under water for many wears. Though no definite samples of methane were obtained from the recent Black Hawk explosion, there is ample reason to warrant the conclusion that the gas which ignited was methane. It is stated by miners in Black Hawk that a few years ago in another Black Hawk mine, a raise was being driven to connect with a timbered winze which had been flooded for several years. The winze was drained by a drill hole, and on the first trip into the raise after the flow of water was controlled, the miners were severely burned by the ignition of a gas of mysterious origin.

Though there is no assurance that methane will always be encountered in dewatering or recovering long-flooded caved shafts and mines, in such work it is certainly advisable to take reasonable precautions at all times. Ample air circulation should be assured and, in general, this can be obtained only by use of mechanical ventilation equipment such as fans, tubing, and complementary apparatus. When necessary to explore recovered timbered territory which has been under water a number of years, it is advisable to use an approved type of coal miners' safety lamp to test for explosive gas, and if it is found to be present, not only should ventilation be supplied but the workers should use only the best types of electric safety lamps until it is certain that all explosive gas has been adequately controlled or wholly removed.

*Bureau of Mines Investigations.

Advisory Committee Appointed for British Metal Mining Industry

The Secretary of Mines for Great Britain and Ireland, acting under the provisions of the Mining Industry Act of 1920, has appointed an "Advisory Committee for the Metalliferous Mining Industry" of the empire, under the chairmanship of Sir Cecil Budd, according to *The Iron Monger*. On this committee mining industries are represented as follows: Iron ore mines and quarries, by Myles Kennedy, S. J. Lloyd, and C. E. Pease; iron ore workers, by Harry Dack, T. Gavan-Duffy, William Lewney, and Will Sherwood; tin-mine owners, by R. Arthur Thomas, and tin-mine workers by Joseph Harris; lead- and zinc-mine owners, by Anthony Wilson, and workers by James Wignall. Mining engineers are represented on this committee by Thomas Falcon, F. H. Hatch, and Frank Merricks; metallurgists, by M. W. Harbord; economic geologists, by T. C. F. Hall, Henry Louis, and J. Malcolm Maclaren; iron and steel interests, by J. Burton; and medical science, by Sir K. W. Goadby. F. C. Starling, of the Mines Department, is the secretary of the committee.

MEN YOU SHOULD KNOW ABOUT

Dr. E. A. Holbrook has been reappointed assistant director of the U. S. Bureau of Mines.

Mark L. Requa, mining engineer, underwent a serious operation recently in San Francisco, Cal.

Wilbur H. Grant, mining engineer, of San Francisco, Cal., is in Mexico on professional business.

P. A. McKenzie, mining engineer of Oakland, Cal., is making inspections in the Kingman district, in Arizona.

Madame M. S. Curie, of Paris, sailed from New York on June 25, having completed her tour of the United States.

Walter L. Reid, of the United Metals Exploration Co., is designing the mill for the United Comstock Mines Co., of Gold Hill, Nev.

E. S. Larsen is making an examination for the U. S. Geological Survey, of the corundum-bearing rocks in the Gretna, Va., area.

Cyril W. Knight, assistant provincial geologist, is at Cobalt, Ont., and will spend the summer there making an underground study of the silver mines.

E. H. Walters, president, and **Charles O. Ball,** secretary, of the Co-operative Mining Co., Lordsburg, N. M., have been in New York on business for their company.

A. G. McGregor passed through New York City last week on his way to Warren, Ariz., returning there from a trip to inspect the new Cerro de Pasco smelter in Peru.

Thomas H. Allan, mining engineer with the Forty-Mile Power & Dredging Co., operating in the Yukon Territory and in Alaska during the last year, has returned to New York City.

Prof. H. O. Hofman, who occupies the chair in metallurgy at the Massachusetts Institute of Technology, Cambridge, Mass., has been elected an honorary member of the A. I. M. E.

Eugene Dawson, mining engineer, of New York City, recently completed examinations of mining properties in New Mexico, Arizona, and Chihuahua and has returned to New York.

Charles A. Mitke, of Bisbee, Ariz., who recently completed a series of lectures at the Massachusetts Institute of Technology, is looking over mines in the Michigan iron and copper districts.

Percy E. Barbour, assistant secretary of the A. I. M. E. who has been indisposed for some time, is reported to be improving. He expects to be able to resume his duties at the Institute before the close of July.

Charles F. Rand, a director and a past president of the A. I. M. E., mining engineer and mine owner, of New York City, has been elected an honorary member of the Iron & Steel Institute of England. There are but four other honorary members, including the King of England and the King of the Belgians.

Dr. George Otis Smith, Director of the U. S. Geological Survey, will sail on July 9 for London to attend a special meeting on July 20 of the organization committee of the International Geological Congress. **Prof. R. W. Brock,** of the University of British Columbia, who is the other delegate from this hemisphere, is the chairman of the organization committee.

Frederick F. Sharpless, secretary of the Mining and Metallurgical Society of America, has just been elected to succeed Bradley Stoughton as secretary of the American Institute of Mining and Metallurgical Engineers.

Mr. Sharpless has been a member of

FREDERICK F. SHARPLESS

the Institute since 1889, the year after he received the degree of B.S. in chemistry from the University of Michigan, but his prompt entry upon an active professional carreer that carried him to all parts of the world, between 1893 and 1912, prevented his accepting confining society duties earlier. On graduation in 1888 Mr. Sharpless was appointed to the chair of metallurgy at the School of Mines in Houghton, Mich., and served in this capacity until 1893, when he resigned to take on private consulting practice. While teaching his work won hearty praise from his associates and contemporaries. While in private practice he was for a time in partnership with H. V. Winchell, of Minneapolis, and during that association gained a wide experience in consulting practice. For many years he was the American representative of The Consolidated Mines Selection Co., Ltd., of London. While still in this position he joined in becoming a charter member of the Mining and Metallurgical Society of America. This society he has served as secretary for two separate terms, and for one term as vice-president.

Mr. Sharpless was born in West Chester, Pa., in 1866, of parents who raised him in the Quaker faith. His judicial and discriminating mental habits, combined with a pleasing gentleness of manner, eminently qualify him to be Mr. Stoughton's successor in the secretaryship of the A. I. M. E.

SOCIETY MEETINGS ANNOUNCED

The Mining Institute of Scotland will hold its next general meeting on Aug. 13 at Glasgow. The meeting planned for June 11, at Edinburgh, was cancelled because of the coal miners' strike and difficulties with the railway services. G. L. Kerr, Royal Technical College, Glasgow, is the secretary.

American Institute of Mining and Metallurgical Engineers holds a fall meeting at Wilkes-Barre, Pa., Sept. 12 to 17, inclusive. The program suggested by the committee in charge starts with a technical session on the afternoon of Sept. 12, followed on the 13th by an all-day excursion through the anthracite region, ending at Scranton, where, on the 18th, another technical session will be held. The same afternoon an excursion through the Wyoming valley brings the party to Wilkes-Barre for the dinner. Technical sessions on the morning of the 19th are followed by visits to special points and the meeting adjourns in the evening.

OBITUARY

Quartus Almon Gillmore, of Lakewood, Cleveland, Ohio, superintendent of the Cleveland ore docks of the American Steel & Wire Co., died at his home on June 9. Mr. Gillmore was sixty years old.

Earl R. Leib, geologist, of San Jose, Cal., with the Southern Pacific Company, died on June 16 from the effects of carbon monoxide which overcame him while he was examining an abandoned mine near Ione, Cal. Mr. Leib fell to the bottom of a 100-ft. shaft. He had been geologist for the Union Oil Co., Los Angeles, Cal., and was a technical graduate of Leland Stanford, Jr., University. His father, Judge S. F. Leib, is also a resident of San Jose.

Captain William J. Richards lost his life in a shaft accident in the Monongahela mine, Crystal Falls, Mich., recently. He and three others were being hoisted from one level to another by a small engine when the cable overwound and then became released, causing the bucket to drop. Captain Richards and one of the others fell to the bottom of the shaft and were killed. He was a son of the late W. J. Richards, who was formerly in general charge of the mines of the McKinney Steel Co., in the Michigan field, and a graduate of the Michigan College of Mines.

THE MINING NEWS

LEADING EVENTS

Little Iron Ore To Be Shipped This Season

Oliver Company's Decision To Curtail Further Dispels Hopes of Optimists —Ore Prices Fixed

From present indications only a light tonnage of iron ore will be moved down the lakes from the Lake Superior iron ranges this summer. Few mines are making regular shipments, and only a small number of lake carriers are leaving Lake Superior ports with cargoes. Until the last week it was thought that the Oliver Iron Mining Co., the largest of the operators, would ship considerable ore, but this company has ordered many of its mines closed, and numerous properties have been placed on a part-time basis. The Oliver laid off 2,000 men in the Virginia district, on the Mesabi Range, and suspended all operations at Iron Mountain and Norway, on the Menominee Range. The mines on the Marquette and Gogebic ranges are working half-time with two crews, the men being at the mines one week and at home the next.

The orders to curtail were issued following a visit to all of the ranges by D. J. Kerr, vice-president of the U. S. Steel Corporation; McGilvary Shiras, ore agent for the corporation, and officials of the Oliver company. Mr. Kerr stated that there are large stocks of ore on hand at the furnaces and at Lake Erie docks, and most of the underground mines are carrying large stockpiles. Some of this large surplus will have to be consumed before the mines can operate on a full-time basis, and the opinion prevails that it will be next spring before conditions on the iron ranges will be back to normal.

Many of the independents are now working a single property, and some are endeavoring to maintain their organizations by operating on a small scale. The depression is greater than any since 1893.

Iron-ore prices have been fixed at $1 less per ton than in 1920, making them the same as in 1919. The base prices are as follows: Old range bessemer, base 55 per cent natural iron and .045 phosphorus dried, $6.45, ranging down to $5.55 for Mesabi non-bessemer, base 51.5 per cent natural iron. The price was fixed June 16. It was established by a sale of 100,000 to 150,000 tons of iron ore by Pickands, Mather & Co. to the Steel Company of Canada, Hamilton, Ont.

Part of Oatman Burned

Fire originating in the St. Francis Hotel destroyed over half of the residential and business districts of Oatman, Ariz., on June 27. No mining property was burned.

WEEKLY RÉSUMÉ

Delay apparently characterized the last week in Washington. Senator Shortridge is withholding his bill for a Department of Mines with a view to making certain changes. The measure intended to liberalize the War Minerals Relief Act is also being held up to permit further consideration. Action is being deferred on proposed amendments to the mining law, while the report of the Ingalls committee is being studied carefully. Strong pressure was brought to bear on the Senate Committee on Mines and Mining to cause it to change its decision against extending the time for doing assessment work on mining claims. The new tariff bill was unexpectedly reported to the House on June 30.

In Illinois, a new mines inspection act, conforming to the so-called "model law," has been passed. On the iron ranges, curtailment is marked, and little ore is expected to be shipped this season. In Texas, a hurricane damaged the plants of the Texas Gulf Sulphur Co. and the Freeport Sulphur Co. on June 22; also considerable property in the Goose Creek oil field. The Freeport company has started to operate its new asphalt plant. In Ontario, arrangements to re-finance the British America Nickel Corporation are reported to have been completed. Organization of three new sections of the A. I. M. E. has been authorized. In Salt Lake City, the Bingham-Galena Mining Co., in connection with which George Graham Rice's name is mentioned, has secured a stock-selling permit despite numerous protests.

Three New Sections of A. I. M. E. Authorized

At a meeting of the directors of the American Institute of Mining Engineers held in New York on June 24, three new sections were authorized. These are to be known as the Calumet (at Gary, Ind.,) section; the Tampico (Mexico) section; and the Charleston (West Virginia) section. The Lehigh Valley section is not yet sufficiently organized for authorization.

The affiliated students' society of the Rennselaer Polytechnic Institute has been recognized.

Freeport Sulphur Now Operating New Asphalt Plant

The asphalt plant of the Freeport Sulphur Co., at Freeport, Texas, has begun operations, and the first shipment, consisting of eleven cars, has been made. The plant is not yet entirely completed. When finished it will have four stills. R. W. Stone, of Houston, is sales agent.

Illinois' New Mines Inspection Act Conforms to "Model Law"

Same as That Drafted by Committee of Leading American Engineers and Published in 1915 by Bureau of Mines

A law known as the Mines Inspection Act, which provides for the health and safety of persons employed in metal mines, has just passed both houses of the Illinois Legislature. It is practically the same as the "Model Law" drafted by a committee appointed by the American Mining Congress in 1906 and consisting of W. R. Ingalls, James Douglas, J. R. Finlay, J. Parke Channing, and John Hays Hammond. In 1909 these engineers were invited to act for the same purpose as a committee of the A. I. M. E. and the Mining and Metallurgical Society of America, and in 1911 as a committee of the U. S. Bureau of Mines. In 1915 the bureau published the final draft of the model law as Bulletin 75. The bill just passed in Illinois was introduced at the suggestion of the fluorspar operators in the southern part of the state.

George Graham Rice Bobs Up Again

Expected To Connect With Bingham-Galena Mining Co.—Latter Gets Utah Stock-selling Permit Over Numerous Protests

A stock-selling permit has been granted the Bingham-Galena Mining Co., of Bingham Canyon, Utah, over the protests of the Utah Chapter of the American Mining Congress, a Salt Lake City brokerage firm and others. On the other hand, a majority of the members of the Salt Lake Stock Exchange asked that the permit be granted. In granting it the commission makes the point that it can be revoked if improper methods should be used and that this is understood by the mining company.

The Bingham-Galena is a reorganization of the Silver Shield Mining & Milling Co. with certain properties of the New York Bingham and United Bingham groups added, and the new company is stated to wish to sell to an underwriter, E. R. Dodge, of Reno, Nev., 467,000 shares of stock. The whole question centers in the fact that although his name nowhere appears, George Graham Rice is admitted by the officials of the company to be behind the proposed transaction, Judge Dodge being his attorney and financial agent. It is felt by those in opposition to the granting of the permit that the entrance of Rice again into the Utah field can hardly be beneficial—in view

of the aim of both the mining industry and of the potential oil industry of the state to maintain a high level. The brokers in favor of the new enterprise hold that the floating of the new company and the possible work in connection with it would bring greater activity and increased employment to Bingham as well as the chance of developing a property of value.

Utah has many properties of potential value, which may be developed into paying mines, and the opinion is expressed that it would be a pity, in view of the many successful mines of the state and the many opportunities available, that a name so widely and not always favorably known as that of Rice should be mentioned, though not directly, in connection with a Utah enterprise. Utah's mineral wealth, both developed and still to be developed, is so great, it is said, that her opportunities do not need to go begging, and this is true despite the present status of mining, with its difficulties and hardships, which will be met, and are being met.

Ontario Mining Association Holds Annual Meeting

The annual meeting of the Ontario Mining Association was held at Cobalt, Ont., June 16-18, with a representative attendance. Among other resolutions adopted was one strongly urging the immediate construction of a railway to open up the mining districts east and west of Swastika. R. B. Watson was elected president.

Washington Magnesite Companies To Furnish Small Tonnage

The outlook for early resumption of some magnesite mining and calcining operations in the Valley district in Washington is somewhat improved, owing to the announcement by the American Mineral Production Co. to the effect that a group of Western steel refiners have reached an understanding to pool their requirements and use from 50 to 100 tons per day of the Washington output. The plan of operation provides for production from the Allan quarry and for burning at the plant of Northwest Magnesite Co., Chewelah, thus giving both that company and the American Mineral Production Co. a share in the business.

G. L. Allen Built Shattuck Mill

In an article describing the present activity at Tombstone, Ariz., that appeared on p. 960 of *Engineering and Mining Journal* June 4, it was stated that "the National Metals Recovery Co. plant is in charge of J. W. Stockham, who erected the Shattuck mill in Bisbee." Mr. Stockham has written saying that this statement is only partly true. He says:

"That I am in charge of the National Metals Recovery plant is a substantial fact, but the credit for the erection of the Shattuck mill belongs entirely to Glenn L. Allen, residing at the present time in Warren, Ariz. I acted in capacity of assistant superintendent at the Shattuck mill for about two and one-half years, but had nothing to do whatever with the erection of same, the mill being completed and in operation when I became associated with this company."

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

House Gets New Tariff Act

Producers of Metals and Ores Receive Various Degrees of Protection—Petroleum on Free List

The new tariff measure was rather unexpectedly released by the Committee on Ways and Means and presented to the House on June 30. Petroleum is on the free list.

Among the duties that are of especial interest to the mining industry are the following imposts: Manganese ore, 1c. per lb.; molybdenum ore or concentrates, 75c. per lb.; tungsten ore or concentrates, 45c. per lb. of tungsten content; ferromanganese containing an excess of 1 per cent of carbon, 2½c. per lb.; ferromanganese metal, 2½c. per lb. and 28 per cent ad valorem; ferromolybdenum, metallic molybdenum, and all other alloys and compounds of molybdenum, $1.25c. per lb. and 17 per cent ad valorem; all other alloys used in the manufacture of steel, 30 per cent ad valorem; aluminum in crude form, 5c. per lb.; plates, sheets and all other forms, 9c. per lb.; antimony 1½c. per lb.; quicksilver, 7c. per lb.; nickel, 5c. per lb.; tin in bars, 2c. per lb.; lead-bearing ores and mattes of all kinds, 1½c. per lb. on lead content; lead bullion, 2½c. per lb.; zinc-bearing ores, containing less than 10 per cent, free; 10 per cent and less than 20 per cent, one-quarter of 1c. per lb.; 20 per cent or more and less than 25 per cent, one-half of 1c. per lb.; 25 per cent or more, 1c. per lb.; zinc in sheets, 1⅝c. per lb.; in blocks or pigs, 1⅜c. per lb.

Little Hope for Frelinghuysen Coal Bill

The Frelinghuysen coal stabilization bill has little chance to pass the Senate. Its companion measure, the seasonal rate bill, has only slightly better prospects. These opinions are generally held, as this is written, although Senator Frelinghuysen himself is sure that he can secure a vote on each measure.

Seek To Sway Committee as to Assessment Work

Strong Last-Minute Efforts Made To Secure Continued Suspension of Annual Requirements

Strenuous efforts were made last week to get the House Committee on Mines and Mining to reconsider its action in declining to report out the bill suspending the 1920 assessment work. There is no evidence, as this is written, that the committee will change its position, but it can be said that great pressure is behind the movement to secure concurrence in the bill which passed the Senate. On the other hand, there is strong sentiment in evidence against any further exemptions from performance of the assessment work.

Government's Silver Purchases Over 60,000,000 Oz.

Purchases of silver under the Pittman Act during the week ended June 25 totaled 1,154,000 fine ounces. This brings the total purchases under the act to 60,485,697 fine ounces.

Delay Likely on New Relief Bill

House May Await Opinion From Comptroller of Treasury—Further Study Desired

Action by the House of Representatives on the bill intended to liberalize the War Minerals Relief Act may be held up awaiting an opinion from the Comptroller of the Treasury as to the action which may be taken on claims which have been the subject of a final ruling. Under the existing rulings of the Comptroller, the liberalization bill, as it passed the Senate, probably could be applied only to about thirty claims on which no action has been taken by the Secretary of the Interior. It is probable that no action will be taken by the House Committee on Mines and Mining until an opportunity has been given by the Secretary of the Interior and by the new War Minerals Relief Commissioner to make a further study of the situation.

Shortridge Holds Back Bill for Mines Department

Senator Shortridge has been delayed in introducing his bill which provides for the creation of a Department of Mines, on account of his desire to study certain changes which, it has been suggested, he ought to make in the draft of the bill that he now has before him. Pressure of other duties has made it impossible for him to study into the effects of these proposals. He expected on June 25, however, to be in a position to introduce the bill within a few days.

NEWS BY MINING DISTRICTS

London Letter

Buena Tierra Reports for Past Year—Deal Off Between Burma Corporation and Associated Lead Manufacturers—West Springs Stops Shaft Sinking To Drift

London, June 14—The report of the Buena Tierra Mining Co. for the last calendar year is a rather depressing document. Funds were provided by an issue of £66,000 in five-year 10 per cent notes (repayable at 125 per cent), and an extended program of development was arranged. On this program about £30,000 was expended, and including it there is a debit balance on the year's working of £34,619.

Here and there indications were given of orebodies carrying hopeful prospects; but all costs had risen to such an extent, and prices of silver and lead had fallen to such unremunerative levels, that operations are to be suspended temporarily as from June 30.

The quantity of ore mined was 7,246 metric tons, of which 461 tons was rejected as waste, leaving 6,795 tons for shipment. The smelter received 6,927 tons, from which the net return was $63,048, or an average of $9.10 per ton. Total costs per ton were $26.55, of which $4.68 represented mining, $5.69 development, $10.09 exploration, and $4.13 general expense.

The course of metal prices, accompanied by variations in the grade of ore shipped, is discernible in the smelter returns, but deductions did not alter in the same proportions.

It is understood that the deal between the Burma Corporation and the Associated Lead Manufacturers has been abandoned. The scheme was for the Burma Corporation to acquire a controlling interest in the Associated Lead Manufacturers by an exchange of securities and the payment of about £100,000 in cash, one of the objects being the purchase by the Associated Lead Manufacturers of the output of the Burma Corporation.

From the statement it is inferred that the result of the meeting of stockbrokers and others recently held at the offices of the New Consolidated Gold Fields was adverse to carrying out the scheme. No official announcement has yet been made, nor has the rumor of abandonment met any denial. The questions now are: Will the A. L. M. buy the production of the Burma Corporation, and will it still be necessary for the corporation to issue new capital to complete the zinc works and the Namtu branch railway line?

The Main Reef series in the Far Eastern Rand is by no means flat; it is of a very undulating character. In the West Springs area this characteristic would seem to be pronounced, for the sinking of No. 2 shaft is to be suspended temporarily, in order to put down a borehole from the bottom of the shaft to locate the reef series. Work is to be concentrated in the No. 1 shaft district, with the object of creating an ore reserve at the earliest possible date. The No. 2 shaft was started nearly two years ago, and has reached a depth of about 2,600 ft. No actual figure was mentioned in the cablegram.

The cessation of shaft sinking and the putting down of a bore do not necessarily mean that the reef series is lost. It may mean either that the contour is not as expected, or that finance is a factor in mining policy at the moment. At the same time, following upon other occurrences, it is a bit depressing for the East Rand.

The phenomenal assays taken in the Akoko Main Reef mine, in West Africa, to which I made reference recently, were 598 dwt., 88 dwt., 38 dwt., and 75 dwt. Only four assays apparently were taken, and these, though interesting, are not of course convincing. Other factors are necessary before any opinion can be formed of the value of the find. Attempts are being made to infuse life into West African gold shares by the publication of such assays.

AUSTRALIA

Queensland

Decided To Start Chillagoe State Smelters Again—Coal and Sapphire Mining Alone Active

Brisbane, May 28—Following the report of the two accountants who investigated the affairs of the Mount Morgan company, and the advice of the industrial judge for the men to accept the 20 per cent reduction of wages which the company had offered, a ballot of the employees on that offer was taken. By a vote of 726 to 547 the men turned it down. Next the state government decided to allow the company a rebate in railroad freights amounting to £1,000 per week if operations were resumed. As the company would, on the showing of the accountants' report, be losing £2,300 per week and making no profit, the offer naturally was not considered good enough, and the mine and works, which had closed down on March 24, still remain idle. No move is now being made on either side, and the only glimmer of hope for a return to work is the slightly rising market for copper, which has gone up from £66 per ton when the mine closed to £77 at present.

Mount Morgan has been producing over 78 per cent of the gold and about 40 per cent of the copper yield of Queensland, so that the closing down of this big concern will mean a heavy reduction in the output of the state.

It has been definitely decided to re-start the Chillagoe State Smelters, which had shut down on March 5, at the beginning of June. When the smelters ceased operating, a number of men were kept on developing the silver-lead mines at Mungana and the copper mine at Einasleigh, in the Etheridge district, all of which mines are now under the control of the government, and it is owing to the discovery of good new orebodies in these mines that smelting can be resumed, the manager hoping that he will be able to at least pay running expenses. In the Mungana mine, it is estimated that there is in sight 30,000 tons of the newly developed ore, and that this will run 10½ per cent lead, 10 oz. silver, and 5 per cent copper. At the Einasleigh mine, which has hitherto been a low-grade property, the new orebody, which is 15 ft. wide, assays 10 per cent copper.

From the cobalt mine, in the Cloncurry center, another shipment, consisting of twenty-two tons of 20 per cent ore, has been sent to England. The first shipment, fifty tons, was sent away four or five months ago.

The general manager of the Mount Morgan company, W. H. Corbould, is leaving Queensland for London to consult with the directors regarding the raising of the money which is needed, but which could not be got in America, to carry out the big scheme outlined by himself—namely, the erection of a central treatment plant at Cloncurry, the extension of the Mount Cuthbert railroad from Dobbin, the present terminus, to the company's Mount Oxide mine, eighty miles northeast, and the opening up of the company's various mines—a project that has an important bearing on the future of the great Cloncurry copper belt.

The most promising, and really the only active, branches of mining in Queensland at present, apart from the search for silver-lead ores in the suburbs of Brisbane, are those connected with sapphires and coal. On the gem fields of Anakie, in the central district, there has been a large increase in production during the last two or three years, and energetic operations are continuing, with every appearance of prosperity, consequent on the large buying that has lately taken place under the arrangements made through the government for the marketing of the gems.

One of the companies operating at Indooroopilly has been working under the guidance of an electrical "diviner." This diviner predicted an orebody first at 42 ft. and then at 65 ft. The shaft is now down 70 ft. without striking the ore and the diviner's last prediction is 72 ft.

CANADA

British Columbia

Gold Output Expected To Show Increase Over 1920—Northport-Rossland Branch of Great Northern May Be Abandoned

Three Forks—Resumption of operations on the property of the MacAllister Mining Co., on the north fork of Carpenter Creek, was to take place about July 1, with a crew of fifteen to twenty men. The plan is to develop and increase ore reserves to justify mill construction next year.

In the same district the Rambler-Cariboo is continuing development with a small crew. The snowslide season is safely past. The annual meeting of shareholders was held at Three Forks on June 14, resulting in the re-election of the former directorate and officers. The matter of resumption of milling operations is being given consideration.

Rossland — An estimate of British Columbia's gold production for 1921 shows a likelihood of an increase of $1,000,000 in output over the preceding year, with an increase from Rossland camp of about $900,000, or $1,500,000 for 1921, as against $600,000 in 1920.

The announcement has just been made by the Great Northern Railway that application will be made to the board of railway commissioners for permission to abandon operation of the Northport-Rossland branch, between the international boundary and Rossland. Vigorous opposition is manifested locally to the move, but the railway officials claim that the Northport-Rossland section of the line has been a source of loss for a long time, a deficit of $48,000 appearing against it for 1920.

Vernon—Owners of mining property through Fire Valley, lying between the Okanogan and Arrow lakes, are encouraged because construction of a government wagon road through the valley is now under way, with promise of completion by next year. The project is of considerable importance to the Lightning Peak section, with a number of promising properties, development of which has been long retarded by lack of transportation.

Trail—Ore received at the Consolidated smelter the week ended June 21 was as follows:

Mine	Location	Tons
Florence, Princess Creek		102
Knob Hill, Republic		50
Company Mines		6,237
Surprise, Republic		87

Ontario

British America Nickel Arranges Re-financing

Sudbury — The British America Nickel Corporation has carried out its scheme for financial reorganization and arranged for capital as follows: $6,000,000 first income bonds; $18,500,000 second bonds; and $20,000,000 common stock. Capt. D. Vogt, president of the Norwegian nickel works, who has been in charge of affairs during the reorganization period, has resigned as president of the corporation and takes the position of vice-president and managing director of the European office. Hon. Edgar N. Rhodes, of Amherst, N. S., speaker of the Canadian House of Commons, becomes president and managing director. A. Gronningsater, who was chief consulting engineer, has been appointed technical director. The corporation is ready to resume operations as soon as the market improves.

Kirkland Lake—The Lake Shore during May produced gold to the value of $29,637, from the treatment of 1,865 tons of ore, this being a recovery of nearly $16 per ton. The mill ran 93.55 per cent of possible running time.

Cobalt — Government assistance in the construction of the projected railway across the mining belt of northern Ontario is regarded as practically assured, judging from the expressions of Harry Mills, Minister of Mines, during his recent visit to the mining districts. The only question appears to be what form government aid will take, which may be either a subscription to bonds or a direct cash bonus. The matter is under consideration by the cabinet, and a speedy decision is anticipated. In the meantime, thirteen miles of the route through Teck, Lebel, and Gauthier townships of the Kirkland Lake district has been surveyed. Many prospectors are staking claims along the route, which would be regarded as valueless without the prospect of transportation.

Holmes Township—A staking rush has set in to Holmes Township, twenty miles west of Kirkland Lake, where a discovery of gold was made last fall. It is on the line of the projected Northern Light Railway.

ALASKA

Falcon Mining Co. Operating on Chichagof Island

The property of the Falcon Mining Co. is at the head of Falcon Arm, Chichagof Island, Alaska, and consists of nine claims and four mill sites. The property at the highest point is 2,310 ft., and a 7 x 7-ft., 1,200 tunnel is being driven into the mountain 600 ft. back from the water and at 160 ft. elevation, which will crosscut the mineralized formation. This tunnel, according to the management, is now in 850 ft. and within another 100 ft. the first ledge which outcrops on the surface (5 ft. in width) will be reached, after which seven more ledges ranging in width of from 2 to 15 ft. will be reached in quick succession. The ore carries gold and silver.

Mine buildings, such as are necessary until the construction of a mill and power plant is begun, are completed, together with a 600-ft. rail tramway connecting the portal of the main tunnel with the 510-ft. wharf. Modern mining machinery and supplies are on the ground, and the development work is being rushed. Sixteen men are employed, working three shifts in the tunnel.

MEXICO

Guanajuato

Committees To Arbitrate Between Capital and Labor To Be Organized in All Centers—Guanajuato Reduction & Mines Co.'s Mill Running Smoothly

Guanajuato—The drop in the price of silver has been a most severe blow to operations in the State of Guanajuato, and much work has been curtailed or stopped entirely. It has also been difficult to bring in the necessary supplies, owing to the congestion in railroad traffic caused by strikes and shortage of locomotives and rolling stock. The mines of Guanajuato are nearly all of low grade, and in most cases operations are being continued only because shutting down would be more expensive than operating at a loss, provided the loss be not too heavy. Those that can afford it are doing development work, as there is confidence that either silver will improve or the cost of supplies will decline to such an extent that it will make possible operations even at the present price of silver.

The State Congress has recently enacted a law, based on certain of the provisions of Article 123 of the National Constitution of 1917, ordering the immediate formation, in all industrial centers, of committees of arbitrage and conciliation to deal with and resolve all questions between capital and labor. These committees are to have an equal number of representatives from capital and from labor and one representative of the State Government, who will have the deciding vote. Much anxiety was at first manifested by all employers, as under the terms of the law capital seems to have everything and labor nothing to lose. Relying upon the good will and sense of the Governor, it is now felt, however, that no serious difficulties will be experienced.

The Guanajuato Reduction & Mines Co. is treating monthly from 18,000 to 20,000 metric tons of ore from its mines and dumps on the Mother vein near the city of Guanajuato. The same company has completed the construction of a mill and cyanide plant on its properties in the La Luz district, about eight miles from Guanajuato. This mill and plant were put in operation Jan. 1 and have been running smoothly for some time.

The primary crushing is done in a 20 x 15-ft. Blake-type crusher, the fines from which, after passing a ⅜-in. Symons (?) vibrating screen, go directly to a 6 x 6-ft. Allis-Chalmers ball mill. The oversize of the vibrating screen is crushed in twenty stamps, the discharge of which passes to a classifier, the oversize going to the ball mill. The fine grinding is done in three 5 x 16-ft. tube mills in closed circuit with Dorr duplex classifiers.

The plant uses the all-sliming counter-current system. The cyanide plant consists of five 36 x 10-ft. Dorr thickeners and four 36 x 12-ft. Dorr agitators. The pulp from each of the thickeners is handled by a No. 4 Dorrco

diaphragm pump. After passing the No. 1 thickener the pulp flows through three agitators in series, after which the solution is changed by passing through a thickener followed by second agitation in one agitator, the washing being done in three thickeners. The discharge from the last thickener goes to a tailings pond, from which the solution is decanted and returned to the mill circuit. The overflow solution from No. 1 thickener, after being passed through the clarifying filter, is pumped through two Merrill precipitation presses located in the precipitation room at the top of the mill. The Crowe vacuum process is used in connection with the Merrill zinc-dust process of precipitation. The mill is giving satisfactory results.

The company is opening up three levels from the new three-compartment shaft at the Rosario mine. The shaft is being sunk to the 150-meter level, which will be reached this month. A surface tram road has been installed, connecting the Pilí mine with the new mill, and a compressor has just arrived for the purpose of sinking an incline shaft and carrying on other development at this mine.

The Guanajuato Consolidated Mining & Milling Co. has shut down its mill and cyanide plant, to which extensive repairs and alterations are being made with a view to increased capacity in the future, when general conditions are more normal. A new compressor plant is being installed at the Sirena mine of the company, in which considerable development work is being done.

The plant of the United Mines Co. at Melladito, La Luz district, has been shut down for some time, but active development work is under way at the Puertecito properties of the company, also in the La Luz district. A new three-compartment shaft is being sunk.

The Pinguico Mines Co. suspended work, with the exception of a little development, on the Esperanza group of mines at Santa Ana, upon which it has a lease and bond. The San Prospero mill and cyanide plant, where the Esperanza ores were treated, had in consequence also to be shut down. The Esperanza ores are of too low a grade to permit of profitable exploitation with silver at its present level.

The Peregrina Mining & Milling Co. is treating monthly about 3,500 metric tons of ore, mainly old fills from the Peregrina mine, with some custom ore.

The Cubo Mining & Milling Co. is treating monthly about 5,000 tons of ore, mostly from the Villapando mine. Considerable development work is being done, including a new interior shaft, and a connection is projected between the Villapando mine and the main shaft of the Tajo de Dolores mine, close to the mill. This connection, which is a long one, probably requiring a year or more to complete, will greatly cheapen and facilitate the handling of the ore between mine and mill. At present the ore is transported over a long surface tramline which is both expensive and unsatisfactory.

The owners of the Asuncion mine, at the village of San Nicolas del Monte, famous as a bonanza mine, are shipping two or three tons of high-grade ore weekly to the smelter, and from 500 to 600 tons of medium-grade ore monthly to the mill of the Peregrina Mining & Milling Co. A little development work is being done, and the installation of a compressor plant and air drills is planned.

The San Cayetano group of mines in the district was leased by a Mexican company which a few months ago completed the erection of a small mill and cyanide plant in which about forty tons of ore is treated daily, a tonnage which will be increased later as more of the old workings are opened up. These mines were great producers in the old days of the Guanajuato camp, and it is hoped that a large tonnage of ore will be found that may be successfully treated by modern methods, the more so as a high percentage of the values is in gold.

NEW MILL AND CYANIDE PLANT OF GUANAJUATO REDUCTION & MINES CO., LA LUZ, GUANAJUATO, MEXICO

The mill and cyanide plant of the Minera de Augustias, in the Pozos camp, is shut down, but development work is going on in the mine. The same statement is true of the Cia. Minera de Providencia, operating near the town of San Felipe.

Sonora

Calumet & Sonora Property Closed Down

Cananea—The Calumet & Sonora property, belonging to the Carnegie Lead & Zinc Co., has been closed down. Pumping from the 900 level has been discontinued. H. S. McKay, manager, is back at Pittsburg, the home office of the company.

The Cananea Consolidated Copper Co. has started development work in some of its mines.

J. M. Gibbs is developing a silver prospect a short distance from the town of Cananea.

CALIFORNIA

Grass Valley Miners Refuse Wage Scale—El Oro Gold Dredging Co. Testing New Ground

Grass Valley—Miners at Grass Valley are reported to have refused to accept the proposed new wage scale reducing wages 75c. to $1 per day, effective from July 1. They have offered to accept one-half of the proposed cut.

Labor conditions in the Mother Lode mines are still unsatisfactory at the smaller properties, as the producing properties have in most instances introduced contract work, and although a reduced wage scale is in operation miners are making as much or more than before the wage scale reduction. The small mine operating under the wage scale cannot get good men. Efficiency has fallen off. One operator states that "it seems that everybody had decided not to work too hard any more. There used to be a lot of skilled miners who would do a real day's work, but no one seems to know where they have all gone." The mine under development is forced to meet high costs, low efficiency, and poor labor.

Tuolumne—The Confidence and Black Oak mines are holding their water down, but are doing no work. The Carlotta mine is under option and has been unwatered preliminary to starting up.

The Old Rawhide mine, unwatered and sampled by the Pittsburgh Silver Peak Mining Co. about six years ago, is reported to have been opened up again and to have made a promising discovery in the foot wall. A small mill has been erected, and it is expected that the mine will be unwatered to the 300 level and a crosscut driven to the new vein.

The Dead Horse, on the east belt of the Mother Lode, is developing a promising orebody and is preparing to drift on its 1,850 level.

Sonora—A new mill, hoist, and compressor have been installed at the National mine.

Chico—In the vicinity of Chico the El Oro Gold Dredging Co. is trying out a block of land which has been in its control for some time. An old dredge formerly owned by the Pacific Gold Dredging Co. is being used to test out the ground. The company's Siskiyou dredge will be placed on this ground if the results are satisfactory.

Jackson—The Kennedy has been unwatered to point 58 ft. below the 3,900 level, leaving 92 ft. to unwater to reach the 4,050 level.

Sacramento—E. C. Bellows, Commissioner of Corporations, has given permission to the Randsburg Silver Mining Co. to sell and issue certain of its securities. This company has an unpatented lode mining claim in what is known as the Coyote Lode Mining Claim situated in San Bernardino County close to the California Rand Silver Inc.'s mine, which is known as the Kelly mine.

Under the permit the company is authorized to issue 255,000 shares to J. W. Kelly, John C. Wray, Harry Alderson, and E. L. Blanck, as consideration for the transfer to the company of the unpatented mining claim. The company also is given permission to issue 245,000 shares at 20c. per share, cash.

There is a provision in the permit requiring that the shares which are issued to the persons named shall be deposited as in escrow. There also is a provision requiring that not more than 20 per cent commission shall be paid on the sale of the shares. The permit contains a paragraph to the effect that purchasers of the shares are advised that the California Rand Silver, Inc., commonly known as the Kelly Silver Mining Co., has filed a protest claiming ownership to any ore that may be discovered beneath the Coyote claim, by virtue of apex rights.

NEVADA

Leadville Mines Resumes — Tonopah Strike Situation Little Changed

Gerlach—The Leadville Mines Co., with property about forty miles north of Gerlach, the nearest railroad station and on the Western Pacific, has resumed production. A. A. Codd, of Reno, secured control of the property in 1919 and built a mill after spending some time in developing the mines. Gasoline power is used. The ore, after coarse crushing, goes to a Marcy mill, then to a Dorr classifier and through two K & K flotation machines; the concentrates pass to a Dorr thickener and Oliver filters. The concentration ratio is six to one, and extraction is said to be about 90 per cent. Production at present is at the rate of twenty-five tons per day, and a carload of concentrates is being shipped every ten days.

Rochester — The Rochester Silver Mines Corporation is operating normally with about 100 men on the payroll. The Nevada Packard Mines Co., which employs sixty men, reports regular normal production.

Spanish Belt—Work on the mill of the Consolidated Spanish Belt Silver Mining Co., with property situated about midway between the old camp of Belmont and Manhattan, is being rushed as fast as possible. The mill is practically completed with the exception of the flotation machines, which should have been on the property by July 1. Capacity will be 50 tons per day, with few additional changes necessary to increase it another 50 tons. Electric power will be used. Mine development continues satisfactory. Crosscutting is being done, and a drift on a new ore showing on the 145 level of the San Pedro shaft is following 8 to 12 in. of ore of good grade.

The Big Four Mining Co., which controls the old Hancock property adjoining the Consolidated Spanish Belt ground, has installed a new compressor and is cleaning out and retimbering the old Hancock tunnel preparatory to doing exploration work. This mine was a producer of high-grade ore many years ago, and the recent excellent results from development in the Spanish Belt mine have induced the present owners to start work.

Tonopah—There are no apparent indications of an early settlement of the strike which has hindered operations in the Tonopah and Divide districts since April 16. The Tonopah Extension started milling operations on a ten-stamp basis on June 15, and reports development footage for the week ending June 18 as 83 ft. The Tonopah Belmont has about a third of a normal crew and is breaking ore and doing development work preparatory to resuming milling operations soon. The Tonopah Mining Co. is making no apparent effort to resume operations. The West End shipped $51,000 worth of bullion on June 18, which represented the cleanup for the first half of June. In the Tonopah "76" ground 78 ft. of crosscutting in favorable formation was accomplished in May by the West End Co., working from its 800 level.

Johnnie—Several "dry washers" have been built and put to work in the placers of the Johnnie district. The dry washers are simple and inexpensive to build, working on the principle of an air jig. The recovery is unusually good and permits prospectors to develop the claims and pay expenses until the main channel is found.

Coarse gold was found two miles south of the Congress mine, and a small rush has taken place. A large number of claims have been staked out.

Coarse gold and nuggets have been found in the Mill Canyon on the Eureka Johnnie ground, and the extent of the pay ground is being ascertained by active prospecting with a view to putting a dry washer in that canyon. In the main Johnnie gulch F. M. Otto is taking good pay dirt from a shallow shaft, and work on a large scale is planned.

Ely—More interest is being shown in outside districts tributary to Ely, and recent development work at Hamilton and Freiburg is giving interesting results. Old properties such as the Mammoth and the Arguile are being prospected. Interest is waning somewhat in the oil possibilities of the Illipah Basin, but little has really been proven to date.

Pioche — Ore shipments from the Pioche district for the two weeks preceding June 23 showed a decided increase, totaling 838 tons. Bristol shipped 395 tons; Black Metals, 376; Consolidated Nevada Utah, 42, and Gypsy Lease, Smith & Smith, 25.

The Nevada Des Moines property recently figured in rather complicated litigation at Des Moines, Iowa. The case will again be heard before the State Supreme Court. The property has no ore developed or extracted.

Silverhorn—Properties are in demand in the new Silverhorn district, and a number of sales have recently been made. On account of the lack of developed ore on the outside properties little cash is paid down, the properties being incorporated and underwritten by Eastern capital. In most instances two-thirds of the amount of the underwriting price is being applied on the expense of development, while the other third goes to the owners of the property, who share with the promoters who have advanced the preliminary money for incorporation and other expenses prior to the actual receipt of moneys under the underwriting agreements. Of course, some properties have been sold outright for cash, but these for the most part have either a valuable location or else have had a good surface showing.

The Nevada Silver Horn Mining Co. has about forty men on its payroll, the Silver Dale fifteen, and the Silver Peer eight. The other incorporated companies have a few men employed. High-grade silver ore still continues to be found over a wide area, and Silverhorn appears to have an assured future, as the presence of high-grade indicates a tonnage of milling ore and warrants the erection of treatment plants.

Fairview—The Columbia Mines Corporation has been formed to take over and develop the Nevada-Fairview group of claims about five miles from Fairview, Nev.

Reno—The Nevada Supreme Court has reversed the decision of the Nye County District Court in the case of Donohue et al. vs. Tonopah Oriental Mining Co. The suit involves validity of the title of the Oriental to the New York claim, on which its gallows frame and hoisting plant are situated over a 900 ft. vertical shaft. The Oriental bought the ground and the sale was contested by Donohue, who alleges that the claim had been forfeited for failure to do the annual assessment work and error in filing declaration of intention to hold the claims. The declaration of intention to hold was filed in Esmeralda County, while the New York claim is located just over the county line and in Nye County.

UTAH

Park City Shipments Drop—Shipments From Eureka—Lead Furnaces in Blast

Park City—Shipments of ore and concentrates for the week ended June 17 amounted to 887 tons, as compared with 1,109 tons the week preceding. Shippers were: Judge allied companies, 382 tons; Ontario, 286; and Silver King Coalition, 269 tons.

Eureka—Shipments from the Tintic district for the week ended June 17 amounted to 137 cars. Shippers were: Tintic Standard, 49 cars; Chief Consolidated, 39; Dragon, 14; Eagle & Blue Bell, 7; Iron Blossom, 6; Iron King, 6; Colorado, 5; Mammoth, 4; Victoria, 4; Swansea, 4; Eureka Mines, 1; and Martha Washington, 2.

Salt Lake City—On June 20, there were three lead furnaces and one matte furnace in blast at the United States Smelting Co.'s Midvale smelter. On the same date, the America Smelting & Refining Co. had four lead furnaces in blast at its Murray smelter, having added two recently.

The International smelter at Tooele had two lead furnaces in blast on June 20.

The United States Smelting Company at Midvale has started work on its new stack and has built the base, which is practically completed. This is 87 ft. in diameter and 10 ft. deep. Between 1,700 and 1,800 cu.yd. of concrete is in the base alone. The stack will be 50 ft. higher than the A. S. & R. stack at Murray (455 ft.), or approximately 505 ft. high. It will cost with flue connections about $300,000. This stack will probably be completed the latter part of the year.

Eureka—The Tintic Standard mill is treating 140 to 150 tons of ore daily, and making a good recovery of the silver in the ore. Experiments are being made with a view to rocovering the lead also, and a small electrolytic plant is being installed, without, however, interfering with the regular work of the mill. The physical condition of the mine is excellent; new ore finds are continually being made. Following the presentation of figures gathered by the company, Federal officials have increased the net valuation of the discovery orebody from their former estimate of $1,800,000 to $4,150,000, which of course gives a much larger depletion reserve. Income tax due the Federal Government for the period of 1916, when the discovery was first made, to 1919 inclusive, is reduced from $360,000 to $84,031.

Colorado

Gateway—The Radium Co. of Colorado is operating its properties with about 200 men. Ore shipments are made from Whitewater station, on the Denver & Rio Grande Ry., and from Placerville station, on the Rio Grande Southern Ry. James S. James is manager. The mines office of the company has been moved from Naturita to Grand Junction.

IDAHO

Increased Activity Reported in Hailey Section

Hailey—With the Independence and North Star mines (Federal Mining & Smelting Co.) in a position to maintain production, and the Bunker Hill & Sullivan company's development of the Bullion and Mayflower groups well under way, the prospect of large-scale mining operations in the Wood River district are considered satisfactory. In the Muldoon section of the Wood River country, the Federal, Golden Glow, Minnie Moore and the Queen of the Hills properties are active, with a renewal of development and prospecting in evidence. More men are now employed at mining in the district than for a number of years.

Sandpoint—A winze started on a small seam of ore showing in the main tunnel of Falls Creek mine early in May, after being put down several feet, disclosed an 8-in. lens of ore, assaying $105.63 in zinc, copper, lead, silver, and gold. At last reports the high grade showed a 5-in. streak of lesser value along each side.

A deed has been filed with the recorder of Bonner County for the transfer of the Spider and Conjecture properties, six miles south of Lakeview, to the Lakeview Silver Mines Co. The consideration involved is $68,000.

After they had driven 32 ft. in faulted ground on the Blue Bird property on Blacktail Mountain lessees picked up the vein with an 8-in. streak of high-grade silver. A shipment of eight tons of similar ore, made before encountering the fault, netted $4,000. The lessees plan to install a small concentrator.

Mackay—A number of prospecting parties will likely be outfitted here this summer to search for placer and lode minerals in central Idaho. One outfit has already left for the Middle Fork country. Additional activity in this section is indicated by the Mt. Sullivan Mining Co. renewing the lease and bond held on the George W. Stewart group on Alder Creek, a cash payment being made. Driving of the main tunnel, which is now 640 ft., is to be continued this season.

Cœur d'Alene City—Caribou Mining Company has acquired two additional claims which may be of value to the company for mill site purposes.

Wallace—A. P. Reinhardt has secured an option on the control of the Sonora Mining & Milling Co. The terms of the agreement have not been made public except that it runs for eighteen months and requires the continuous employment of at least four men. The deal also includes a lease under which the company will receive a royalty of 10 per cent on all ore shipped. The property is situated near Burke and has been developed to the extent of approximately 4,000 ft. of underground workings. Considerable lead-silver ore has been found, but not of commercial quantity.

MONTANA

Hearing on Butte & Superior's Accounting With Minerals Separation Under Way

Butte—Drifting for the copper vein disclosed some time ago on the 2,050 level of the Black Rock mine of the Butte & Superior is under way on the 2,200 level, and it is expected to reach the fissure within two or three months. The hearing on the accounting in the case of the Minerals Separation company against the Butte & Superior is being held before Federal Judge G. M. Bourquin at Helena.

About two and one-half feet of good silver ore has been uncovered by the Butte & Plutus in the Norwich vein on the 400 level.

Some drifting is being done by North Butte on levels below the 2,000 level. A raise is under way and possibly two will be driven. Operations in the main, however, are more on the order of marking time, meanwhile keeping the property in repair. Seventy men are employed.

Driving of raises for more ore chutes is the chief feature of the work at Davis-Daly's Colorado mine at the present. At the Hibernia shaft a sinking from the 600 to the 800 level has begun.

Corbin—Official announcement has been made of plans for extensive development of the Alta-Montana property, formerly one of the large producers of Montana. A mill, to be built at Corbin, is also a possibility of the near future. New York capital is chiefly interested.

WASHINGTON

Sylvanite Concentrator To Be Started Soon

Swauk District—The small concentrator constructed for the Sylvanite Mining Co., in the Swauk mining district in Kittitas County is expected to be in operation about the end of July. The ore is said to run about $20 per ton in gold and silver. Arrangements have been completed for shipping concentrates to the Bunker Hill smelter.

Republic—The Knob Hill mine is maintaining steady shipments to the Trail smelter.

NEW MEXICO

Development Work in Progress at 85 Mine—Rosedale Property Sold

Lordsburg—At the Eighty-five Mine Branch of the Calumet & Arizona Mining Co. development work continues on the 950 and 1,050 levels. Ore from this work is shipped to the Douglas smelter. The work of sinking the main shaft 300 ft. further, making a total depth to the lowest workings of 1,350 ft., was started July 1. Karl I. Mohler is manager.

The Co-operative mine has shipped another car of silver-lead concentrates to the El Paso smelter.

William Ragsdale's lease on the Ruth property has expired. One car of ore running 34 per cent lead with good silver values was shipped. The property has been taken under lease by

William Karwer and associates, of El Paso. A camp has been built and work started.

Socorro — The Rosedale gold mine, thirty miles southwest, has been sold for a consideration reported to be $250,000 and will be incorporated for $600,000. The sale was negotiated by Colonel M. R. Crawford. The property has been idle for about ten years. New equipment of mining machinery and a new stamp mill will be installed.

Hachita—The old Gillespie mine has been opened and a 50-ft. crosscut run intersecting several small streaks of high-grade silver ore. On the Thanksgiving claim adjoining, a 30-ft. shaft has been sunk opening a vein of 50-oz. silver ore. A gas hoist has been installed. M. D. Lincoln is in charge.

ARIZONA

Don Luis Section of Warren District Active

Bisbee—The Calumet & Arizona continues the work of concreting the Campbell shaft. Sinking was discontinued some time ago due to the fact that considerable water was encountered. Connection is made with the 1,400 level of the Junction. A drift is now being driven on the 1,800 level of the Junction to connect with the Campbell. Recently this drift struck a large flow of water, and 1,500 gal. per min. has been added to the amount handled at the Junction, which brings the total above 4,000 gal. per minute.

There is considerable development activity in the Don Luis district. The Boras Leasing Co. is enlarging the Boras shaft from one and a half compartments to two and one-half compartments. About 80 ft. has been completed. Work of enlarging has been started from the 400 level and is proceeding toward the collar. The White Tail Deer shaft is being sunk. Work is being done on three shifts.

The Night Hawk Leasing Co., after sinking its winze on the 650 level on the Lone Star fraction to a depth of 35 ft., has discontinued work and is now running the 750 level to explore beneath this territory. The winze bottomed in ore and altogether sufficient ore was opened up to warrant the extension of the 750 level.

The Wolverine & Arizona is doing considerable development work.

MICHIGAN

Gogebic Range

M. A. Hanna and Pickands-Mather Stop Injunction Proceedings Against Wakefield

Ironwood—The Geneva mine, near Ironwood, is being shut down completely. All tools and underground equipment are being removed, but the mine will not flood, as the water drains over to the Davis mine. At the latter property the work of repairing the 26th-level pump station, where several thousand tons of rock crushed in the roof, is nearing completion. The rock has been cleared away and a 4-ft. reinforced concrete wall is being built across the middle of the pump house to support the roof, and the entire roof system is being strengthened with heavy steel.

"H" shaft of the Pabst mine made its first shipment of ore on June 17, just as orders were received to cut production in half. However, regular shipments will be made on the reduced scale.

The big 30 x 72-in. duplex steam hoist which the Ashland mine bought from the Norrie when the latter changed over to electric hoisting has been erected at No. 9 shaft and is now ready for operation.

Wakefield — The M. A. Hanna and Pickands-Mather subsidiaries operating the open pit mines at Wakefield have discontinued their injunction proceedings against the city of Wakefield on condition that only part of the bonds recently authorized by the city shall be used for erecting a community building. The sum of $145,000 had already been raised for that purpose, and $100,000 additional was held to be unnecessary.

The L. E. Meyers Co., which through several subsidiaries furnishes electric light and power to the mines and cities on the range, had a bad break-down at its steam generating station in Ashland. The main generator, rated at 5,000 kw., was almost completely burned out. The company is having difficulty in taking care of its load, especially as one of the dams is in a weakened condition and the pond had to be lowered. There is also less water in the streams than a few weeks ago. The pumping plant of the city of Ironwood is using its auxiliary gasolene-driven pumps. Fortunately, the demand from the mines for power is far below normal. Pumping continues, but compressors and hoists are not working more than half time if at all.

Hamilton, Wis.—The Montreal mine, at Hamilton, Wis., where the forces had been cut to 250 men, has again reduced operations and laid off half the men and stopped all development work.

MINNESOTA

Plans of Palatine Mining & Development Co. Outlined

Duluth—Officers of the Palatine Mining & Development Co., which has recently taken over the old Paulson mine in northern Minnesota, are as follows: Joseph Mierzynski, president, Chicago; Frank Wydra, secretary, Chicago; Stanley Grzybowski, treasurer, Chicago; Arthur Mitchell, consulting engineer, Duluth; Thomas Krakowiak, chemical engineer, Palatine City, Minn.; Roman Turczynowicz, construction engineer, Chicago; Maximillian J. St. George, general counsel, Chicago; James Ostrowski, director, Chicago, and Edward A. Zolkowski, director, Chicago.

The Paulson property comprises about 1,000 acres. In addition about 1,500 acres adjoining the Paulson have been taken over. The Canadian National Railways is being extended, or rather, rehabilitated, from its present end of track at North Lake, Ont., to the holdings of the Palatine company, in Cook County, Minn. The company has also purchased the blast furnace located at Port Arthur, Ont., which will be enlarged and put in operation.

Mesabi Range

Pilot Mine Resumes Work—Many Oliver Properties Close or Curtail

Mountain Iron—The Pilot mine, operated by the M. A. Hanna Ore Co. as an open pit, has resumed operations, with a steady shipment of ore to the docks.

Buhl—The pit limits of Butler Bros., Margaret mine are being extended to the east.

Plans for deepening the shaft at the Oliver's Wanless mine have been completed, and the work will start soon. The shaft is 180 ft. below the collar and is to be sunk an additional distance of 70 ft.

Coleraine—The Arcturus mine of the Oliver company has suspended operations. About 140 men were thrown out of employment.

Chisholm—The Oliver company has closed its Chester mine; also its Glen pit, and at its underground workings and at the Fraser open pit are being worked only one shift. Approximately 275 men are effected.

Virginia—The Missabe Mountain open pit, operated by the Oliver company, has reduced its shipments for the season. About 200 men have been laid off.

Eveleth—The Oliver company has either closed or curtailed at the Genoa, Fayal, Spruce, Adams, and Leonidas mines. About 900 men were thrown out of employment.

Hibbing — The Oliver company has closed the Morris open pit, the Sweeney open pit, the Pool underground workings and the Philbin underground workings. Five hundred men were thrown out of employment.

It has just been announced from the office of the state mineral land examiner that the state-owned mines were shipping approximately 40 per cent of the amount of ore that was shipped at this time last year.

The Mahoning mine, operated by the Mahoning Ore & Steel Co., has closed for four or five weeks. Two steam shovels will continue the operation of stripping.

Keewatin—The general orders for the closing of the properties of the Pickands-Mather Co. have been changed as preparations are being made to ship approximately 500,000 tons of ore from the Bennett mine. Two steam shovels will be used grading the ore and handling the tonnage.

Grand Rapids—The Tod-Stambaugh company has acquired additional acreage west of Grand Rapids. The tract of eighty acres lies in Sec. 13, Tp. 55, R. 26, which is in Itasca County nearly adjacent to the first tract acquired several months ago. It is planned to build a mill to treat the ore on this property.

THE MARKET REPORT

Daily Prices of Metals

June	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
23	12.50	28.125	29.00	4.25@4.40	4 10	4.35@4.40
24	12.50	27.875	28.875	4.25@4.40	4.10	4.30
25	12.50	28.00	29.00	4.30@4.40	4.125@4.20	4.25@4.30
27	12.50	28.00	29.00	4.30@4.40	4.125@4.20	4.25
28	12.50	28.125	29.00	4.35@4.40	4.125@4.25	4.25
29	12.50	28.00	29.00	4.40	4.125@4.25	4.20@4.25

*These prices correspond to the following quotations for copper, "delivered": 12.75c. for the week.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

June	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
23	69¾	70	74	165½	167¾	22¼	22⅛	26½	27⅛
24	69⅞	69⅝	73½	165¾	167¾	22½	22⅜	26⅝	27¼
25	...	...	...	.....	.....	...	...	...	...
27	70⅛	70⅞	74	166⅝	168⅞	23⅛	23	27⅜	27⅜
28	70¼	70⅝	74	166½	169	23½	23¼	26¾	27⅛
29	70¼	70½	74	166	168¼	23⅜	23	26¾	27¼

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

June	Sterling Exchange	Silver			June	Sterling Exchange	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York, Foreign Origin	London
23	374½	99¼	58⅛	35⅛	27	375½	99¼	58¾	35⅛
24	373	99¼	58⅛	35	28	375½	99¼	59	35⅛
25	373	99¼	58⅛	35⅛	29	375	99¼	59½	35⅜

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, June 29, 1921

Business has been somewhat more encouraging in copper, lead and zinc during the last week, although lead is the only metal the price of which has shown firmer tendencies. No large sales have been reported, however, and as domestic business conditions show no improvement, it is unlikely that the metal market has taken any distinct permanent turn for the better. The stock market seems to have reacted upward, and the settlement of the British coal strike is reported; and both of these facts tend toward a better feeling in markets generally. Not much business activity can be expected in July and August, however.

Copper

Demand has been a little more satisfactory than it was last week, but no large orders are reported. The price level is virtually unchanged, but there are now many more producers willing to consider bids of 12.75c., delivered, than there were formerly. Some of the largest producers are now quoting this price confidentially to preferred customers, but are trying to hide the fact from the general public. A little copper for August delivery has been sold at a premium of ⅛c. One of the smaller Arizona producers who has always sold all his current production is understood to be marketing some metal at 12.625c., delivered, and this price is also being quoted by some traders, but the larger volume of copper sold is at the price which we quote.

Export demand continues weak. Germany continues as almost the sole buyer through the Copper Export Association, with a very small tonnage to France. The price has been unsatisfactory, netting producers not more than 12.50c. f.a.s. New York.

Lead

The A. S. & R. price of 4.40c., which was established a week ago today, continues unchanged.

A buying movement, not of large proportions to be sure, but still very discernible after the dullness of the last few weeks, appeared about Friday. White-lead and paint interests have been the chief factors, but cable and cartridge manufacturers have also been in the market, and supply houses have taken a few small tonnages. Much of this business has been done on the St. Louis basis, and except for chemical lead held by one producer at close to 4.125c. supplies at current prices are scarce. This has resulted in the St. Louis price advancing more than the New York figure has. Lead is probably in the strongest position of all of the metals, a fact which is evidenced by the immediate increase in prices which takes place every time buying of consequence sets in. A 10-point premium is quoted for August business over June-July figures.

Zinc

The market has declined daily, and although sales cannot be said to be satisfactory, comparatively large amounts were sold to galvanizers throughout the week. Whether the cut in iron and steel prices induced buying, or the unusually attractive low level of the market was responsible, is not known. Several of the larger producers are almost entirely out of the market, and are only filling the requirements of favored customers. Some zinc was sold as low as 4.20c., East St. Louis. Futures are neglected.

Stocks of zinc, as a consequence of the enforced dullness in the trade, have increased, which is a disappointing element in the situation. Considering that production has been cut to the bone, the increase in stocks, about 4,000 tons during May, indicates how stagnant the zinc market has been.

Tin

The British coal strike seems to have had little effect on the price of tin. No price recession to speak of was in evidence at the height of the strike, and now that it is to be settled, no advance is resulting. Demand in this country is almost entirely confined to small tonnages bought and sold by traders, and consumers remain out of the market.

The tin-plate business seems to be in a bad way. Tin for forward delivery is quoted nominally at the same prices as those indicated for spot.

Arrivals of tin, in long tons: June 21, Australia, 20; 22d, Straits, 500; 24th, Rotterdam, 25; Straits, 50; 25th, China, 10.

Gold

Gold in London: June 23d, 109s. 9d.; 24th, 110s. 5d.; 27th, 109s. 6d.; 28th, 109s. 5d.; 29th, 109s. 3d.

Foreign Exchange

The exchange market is exhibiting a seasonal dullness, and in the last week price changes have been within a narrow range. On Tuesday, June 28th, francs were 8.055c.; lire, 4.95c.; and marks, 1.3775c. New York funds in Montreal, 13⅛ per cent premium.

Silver

The silver market has been fairly steady in London the last week, ruling between 35d. and 35⅝d., closing at the latter price on China buying. The New York market has been higher than the London equivalent on buying by China banks for San Francisco shipment. Supplies of silver have been moderate, which has helped to steady prices. There has been some decrease of silver stocks held in Shanghai, and reports from India indicate favorable progress of the monsoon, and with somewhat brighter economic conditions in China the trend of the silver market seems steady or possibly higher, unless some governmental action by Germany or England in the sale of silver should depress the market. The purchases of domestic silver under the Pittman Act amounted to 59,635,697 oz. up to June 24.

Mexican Dollars—June 23d, 45; 24th, 45; 25th, 45; 27th, 45; 28th, 45¼; 29th, 45½.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 28@28.5c. are nominal. Outside market, 22@23c. per lb.; 22½c. for imports, duty paid.

Antimony — Chinese and Japanese brands, 4⅞c.; market dull. W.C.C. brand, 5⅜@5⅝c. per lb. Cookson's "C" grade, spot, 9@9½c. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 6@6½c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb., 500-lb. lots.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt — Metal, $3@$3.25 per lb.; black oxide, $2.35 per lb. in bbls.

Iridium—Nominal, $165@$185 per oz.

[1]Molybdenum Metal in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70@$80 per troy oz.

Palladium—$65@$70 per oz.

Platinum—$75 per oz.

Quicksilver—Nominally, $46@$47 per 75-lb. flask. San Francisco wires $46.50.

[1]Rhodium—$150 per troy oz.

[1]Selenium—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]Thallium Metal—Ingot, 99 per cent pure, $20 per lb.

[1]Tungsten Metal—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr_2O_3, crude, $20@$25 per net ton; ground, $30; analyzing 45@50 per cent Cr_2O_3, $30; ground, $35; f.o.b. Atlantic ports. Quotations are nominal. Market very dull.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $6.45; Mesabi bessemer, 55 per cent iron, $6.20; Old Range non-bessemer, 51½ per cent iron, $5.70; Mesabi non-bessemer, 51½ per cent iron, $5.55. Prices have been reduced $1 per ton for the 1921 season.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $5.80; old bed concentrates, 63 per cent, $6.70; Harmony, cobbed, 63 per cent, $6.70; new bed low phosphorus, 65 per cent, $9.50.

Manganese Ore — 25c. per unit, seaport; chemical ore (MnO_2) $55@$60 per gross ton, lump; $70@$75 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]Titanium Ores—Ilmenite, 52 per cent TiO_2, 1½@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York. Nominal.

[1]Zircon—Washed, iron free, 3c. per lb.

[1]Zirkite—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., June 25—Zinc blende, per ton, high, $26.45; basis 60 per cent zinc, premium, $21; Prime Western, $20; fines and slimes, $19@$16. Average settling price, all grades of zinc, $23.31.

Lead, high, $56.25; average settling price, all grades of ore, $43.92 per ton.

Shipments for the week: Blende, 4,823; lead, 2,036 tons. Value, all ores the week, $201,830. Shipments for six months: Blende, 134,180; calamine, 80; lead, 29,583 tons. Value, all ores six months, $4,805,950.

The bulk of the Oklahoma zinc ore sold on $21 basis, and the Waco ore, with an 80c. favorable freight differential, has that additional factor in settlements.

Lead ore halted in the downward course that has marked the last five weeks, dropping from $60 to $40 per ton in that time.

One smelting company is purchasing zinc ore, building bins and storing it in the Oklahoma mining area.

Platteville, Wis., June 25—No sales of zinc or lead ores. Shipments for the week: Lead ore, 30 tons. Shipments for the year: Blende, 11,461; lead ore, 940 tons. Shipped during week to separating plants, 368 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $1,700@$2,000; No. 2, $1,200@$1,500; spinning fibers, $400@$800; magnesia and compressed sheet fibres, $275@$400; shingle stock, $95@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton, f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7@$10 per long ton, f.o.b. Cartersville, Ga. Prices largely nominal.

Bauxite — French bauxite, $8@$10 per metric ton, c.i.f. Atlantic ports. American bauxite, crushed and dried, $8@$10 per gross ton, f.o.b. shipping points; pulverized and dried, $12@$15 per gross ton, depending upon grade; calcined so as to remove most of the combined water, $20 per gross ton, f.o.b. shipping point.

Chalk—English, extra light, 5c. Domestic light, 4½c.; heavy, 4c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $7@$9; washed, $9@$10; powdered, $13@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $13@$20, f.o.b. Virginia points. Imported lump, $12@$20, f.o.b. American ports; powdered, $20@$25, f.o.b. New York.

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c., f.o.b. New England points.

[1]Furnished by Foote Mineral Co., Philadelphia, Pa

Feldspar—Crude, $7@$9 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$8.50, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine. No. 1 Canadian, $26@$28, f.o.b. cars. Market quiet; prices largely nominal.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $18 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; ground, suitable for acid, chemical or enameling purposes, $32@$35; lump, $13.50, f.o.b. Lordsburg, N. M. Ground acid grade, 97 per cent CaF_2, $30, New Mexico. Good demand for ground grades in West.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 7@8c. per lb.; chip, 5½@6c.; dust, 3@4½c. No. 1 flake, 6½@7c.; amorphous crude, ¾@2¼c. Market quiet.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$1.75 per net ton; 1½ in., $1.35@$1.70. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $56 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead-Burned — $33 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $53.80 per ton, f.o.b., Chester, Pa. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.; No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); ground roofing mica, $25@$70, all f.o.b. New York.

[1]**Monazite** — Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $12.50; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $6.75; 68 per cent, $6.25; 68@66 per cent, $6.

[1]Foote Mineral Co., Philadelphia, Pa.

Pumice Stone—Imported, lump, 3@40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 14c., c.i.f. Atlantic seaport; furnace size, 14c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 12 @ 14c.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$16@$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $16@$35, talcum powder grade. Southern talc, powdered, carload lots, $8@$12 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic — White arsenic, 6½c. per lb. in carload lots.

Sodium Nitrate—$2.85@$3 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $18@$20 per ton, f.o.b. Western mines, spot and six months' contract; $33@$35 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.50@$1.75 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 14c. per lb. of chromium contained; 4 to 6 per cent carbon, 15c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $75@$80, f.o.b. furnace; resale, $90, delivered; English, $75@$80, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $28@$32, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works. Imported material, $1.70@$2.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $40@$42; 50 per cent, $68@$72; 75 per cent, $140@$145.

Ferrotungsten—Domestic, 70 to 80 per cent W, 50@55c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$5@$6 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 21½@21¾c. per lb.; wire, 14¼@14½c.

Lead Sheets—Full lead sheets, 8.25c.; cut lead sheets, 8½c. in quantity, mill lots.

Nickel Silver — 31½c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal — Dimension sheets 17½c.; sheathing, 16½c.; rods, ⅝ to 3 in., 14½c.

Zinc Sheets—$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

Refractories

Bauxite Brick—56 per cent alumina $35@$50 per ton, f.o.b. works.

Chrome Cement—40@45 per cent Cr_2O_3, $30@$32 per net ton, and $31 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $60@$65 per net ton, shipping point; arches, keys, wedges, $66; splits, soaps, $84.

Fire Brick—First quality, 9-in. shapes, $35@$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $30@$35.

Magnesite Brick—9-in. straights, $70@$75 per net ton; 9-in. arches, wedges and keys, $77; soaps and splits, $98, f.o.b. works.

Silica Brick—9-in., per 1,000: $35@$45 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, June 28, 1921

The stoppage of orders for steel products passes all previous conception. Experience before the war was that the minimum requirements in the worst times would be about 50 per cent of mill capacity, but for several weeks the mills have operated at not over 25 per cent, and a rate below 20 per cent is to be expected for July. One point of difference is that buyers, including jobbers and manufacturing consumers, are making the strongest effort in the history of the trade to dispose entirely of their stocks, and thus there is reselling that keeps some orders away from the mills. Some buyers evidently expect sharp further reductions in steel prices.

The only general reductions from the so-called "April prices" have been $5 a ton in wire products, about a month ago, and $5 a ton in sheets, about a week ago.

With such light operations production costs are extremely high, and additional mills are deciding that it does not pay to try to operate.

Pig Iron—There is practically no business to test the market, prices being largely nominal, but quotable on offerings 50c. lower on bessemer and basic and $1 on foundry, at $22.50 for bessemer, $20.50 for basic, and $21.50 for foundry, f.o.b. Valley furnaces, freight to Pittsburgh being $1.96.

Coke

Connellsville — Furnace, $3@$3.25; foundry, $4@$4.50.

Cadmium Above Pre-War Level

1920 Production Was Continued on War Scale—German Output Now Declining

CADMIUM is a byproduct metal, and its production is dependent upon the output of the major metal, zinc, or some chemical process from which it is also recovered as a byproduct, such as lithopone manufacture, which uses a zinc chemical. The principal producers in the United States are the American Smelting & Refining Co., the U. S. Smelting, Refining & Mining Co., Grasselli Chemical Co., Krebs Pigment & Chemical Co., and the Midland Chemical Co. The first two companies derive cadmium from lead smelters, treating zinkiferous lead ores, and an electrolytic zinc plant; the remainder obtain the metal from chemical works.

Cadmium production in the United States fluctuates greatly, as the following table, prepared by the U. S. Geological Survey, indicates:

	Metallic Cadmium		Cadmium Sulphide	
	Quantity, Lb.	Average Price per Lb.	Quantity, Lb.	Average Price per Lb.
1910	4,700	$0.55	.....	.....
1911	26,152	.67	2,392	$0.70
1912	52,508	.76	8,998	.71
1913	54,198	.77	17,302	.70
1914	91,409	.89	22,723	.89
1915	91,415	1.19	10,624	1.13
1916	135,212	1.56	22,176	1.26
1917	207,408	1.47	50,169	1.41
1918	127,164	1.48	51,702	1.36
1919	99,939	1.22	31,197	1.20
1920	129,283	1.17	32,133	1.16

It is noticeable that the average price of cadmium during the war jumped greatly over the pre-war average, due partly to the cessation of imports from Germany. The price of cadmium at present is $1@$1.10 per lb., which is below the 1920 average, but greater than the pre-war scale of prices. As production in the United States is only about sixty-five tons annually, the price received for the metal is not of much consequence to the corporations producing it, except that there are incidental costs of recovering the metal which influence prices.

The cadmium resources of the United States have never been strained, as the demand for the metal is confined to comparatively few industries, such as the manufacture of fusible alloys and paint pigments. It is estimated by the U. S. Geological Survey that at the end of 1918 about 750 tons of recoverable cadmium in zinc residues was available, or many times more than the annual consumption in the United States. The heavy sales in 1920 resulted in reducing stocks.

If the demand and price of cadmium should increase, production could readily respond, but as the uses of cadmium have not expanded greatly there is no warrant for looking for any improvement in the near future. Experimental work in the endeavor to increase cadmium uses is necessary.

Before the war Germany produced relatively larger amounts of cadmium than the United States. Thus in 1910, 90,516 lb. of metallic cadmium was produced; in 1911, 93,961 lb.; in 1912, 94,262, and in 1913, 81,993 lb. In 1918, production reached a peak of 236,000 lb. German and American production together constitute practically the world's total production.

Transvaal Gold Production

The following table summarizes Transvaal gold production since 1917:

RAND GOLD OUTPUT 1917–1921, IN FINE OUNCES

	1921	1920	1919	1918	1917
January	681,382	670,503	676,059	714,183	782,634
February	671,123	625,330	636,728	659,759	721,321
March	588,137	707,036	712,379	696,281	787,094
April	651,593	686,979	694,944	717,099	742,778
May	687,776	699,041	724,995	741,217	729,385
June	.....	715,957	702,379	727,696	759,724
July	.....	736,099	725,497	736,199	757,890
August	.....	702,083	706,669	740,210	756,658
September	.....	682,173	698,558	708,206	738,231
October	.....	662,472	723,722	679,764	751,290
November	.....	633,737	677,970	658,701	722,839
December	.....	632,215	650,191	641,245	722,419

Movements of Ores and Metals

Imports and exports of the more important metals and ores, as reported by the Department of Commerce, for May, 1921, and the figures for May, 1920, as finally revised, are as follows:

IMPORTS, MAY, 1920 AND 1921

(In Pounds, Unless Otherwise Stated)

	May, 1920	May, 1921
Antimony ore, contents	26,625	.....
Antimony matte, regulus or metal	2,296,000	891,180
Brass, fit only for remanufacture	4,216,563	984,628
Copper:		
Ore, contents	5,449,040	1,153,410
Concentrates, contents	4,720,868	1,102,147
Matte, regulus, etc., contents	437,463	817,150
Imported from:		
Spain	427,111	164,880
Canada	2,277,313	991,900
Mexico	2,778,787	511,633
Cuba	1,453,742	902,397
Peru	539,129	501,897
Unrefined, black, blister, etc	23,920,357	5,171,667
Imported from (in part):		
Canada	2,450,910	160,142
Mexico	8,913,745	930,790
Chile	2,424,174	88,117
Peru	8,367,902	3,370,764
Refined, in bars, plates, etc	18,580,986	7,400,392
Old, etc., for remanufacture	665,121	58,321
Composition metal, copper chief value	87,076	58,421
Lead:		
Ore, contents	5,623,742	1,209,508
Bullion, contents	3,258,425	8,466,192
Imported from (in part):		
Canada	208,880	208,170
Mexico	8,413,133	8,713,712
Pigs, bars and old	3,170,707	23,482,927
Imported from:		
England	224,000	.....
Canada	8,627	.....
Mexico	560,032	4,443,233
Peru	9,275	.....
Australia	2,368,773	.....
France	.....	11,200,000
Spain	.....	7,839,694
Manganese ore, long tons	56,586	54,663
Imported from (in part):		
Cuba, long tons	118	.....
Brazil, long tons	30,100	26,849
British India, long tons	14,300	21,300
Tungsten ore, long tons	96	370
Pyrites, long tons	25,329	19,143
Imported from:		
Spain, long tons	17,629	19,139
Canada, long tons	7,700	.....
Tin ore, long tons	3,120	425
Tin bars, blocks and pigs, etc	9,102,341	2,021,762
Imported from (in part):		
United Kingdom	3,065,287	828,941
Straits Settlements	4,286,663	1,078,409
Hongkong	973,011	43,842
Zinc		
Ore, contents	4,042,627	5,820
Imported from (in part):		
Mexico	2,653,621	5,820

EXPORTS OF COPPER, LEAD, AND ZINC

(In Pounds)

	May, 1920	May, 1921
Copper:		
Unrefined, black, blister, etc	111,880	11,138
Refined, in ingots, bars, etc	72,107,577	32,259,011
Exported to (in part):		
Belgium	3,450,000	1,188,531
France	17,803,625	4,454,538
Germany	7,055,336	7,073,597
Italy	81,364	2,345,608
Netherlands	3,895,917	2,623,529
United Kingdom	14,810,044	6,765,201
Composition metal, copper chief value	61,524	2,100
Old and scrap	13,698	2,960
Pipes and tubes	296,622	120,834
Plates and sheets	4,883,671	275,695
Wire, except insulated	5,248,746	2,706,213
Lead:		
Produced from domestic ore	363,986	119,700
Produced from foreign ore	4,785,752	505,375
Exported to (in part):		
Netherlands	291,200	.....
United Kingdom	1,021,144	.....
Canada	62,674	50,626
Japan	2,464,000	448,000
Zinc:		
Dross	675,593	.....
Spelter:		
Produced from domestic ore	14,868,768	135,365
Produced from foreign ore	2,134,383	.....
Exported to (in part):		
Japan	82,462	112,013
France	2,483,939	.....
United Kingdom	13,460,960	.....
heets, strips, etc	2,607,059	214,74

COMPANY REPORTS

Tennessee Copper & Chemical Corporation

A report of operations of the Tennessee Copper & Chemical Corporation for 1920 states that 10,358,237 lb. of copper, 333,629 tons of sulphuric acid, 55,586 oz. of silver, and 237 oz. of gold were produced, and that a deficit of $285,889 was incurred, compared with a deficit of $675,379 in 1919. Consolidated income account follows:

	1920	1919	Changes	
Sales	$5,782,998	$3,889,623	Inc.	$1,893,375
Miscellaneous income	296,701	346,657	Dec.	49,956
Total income	$6,079,699	$4,236,280	Inc.	$1,843,419
Operating and miscellaneous expense	5,917,049	4,307,047	Inc.	1,610,002
Interest on bonds, etc	81,175	254,612	Dec.	173,437
Reserve for depreciation	367,364	350,000	Inc.	17,364
Deficit	285,889	675,379	Dec.	389,490

Consolidated balance sheet follows:

ASSETS

	1920	1919
Mining property, plant and equipment	$11,084,862	$9,380,945
Cash	461,970	275,494
Investments	3,257,535	1,429,835
Call loans and accrued interest	150,311	.....
Liberty bonds, etc	1,463,479	3,793,679
Tennessee Copper bonds	175,000	.....
War Finance Corporation 5 per cent gold bonds	.....	658,329
Copper inventories	872,432	609,185
Other inventories	864,217	694,052
Accounts receivable	398,273	169,043
Railroad freight claims	50,899	55,316
Deferred charges	1,070,752	1,191,117
Total	$19,849,730	$18,256,995

LIABILITIES

Tennessee Copper & Chemical Corporation stock (794,065 shares)	$4,000,000	$4,000,000
Tennessee Copper Co. stock	5,000,000	5,000,000
Tennessee Copper Co. first mortgage bonds	2,326,000	2,487,500
Southern Agricultural Chemical Corporation	1,000,000	150,000
First mortgage notes	449,000	.....
Accounts, bills and vouchers payable	448,357	730,420
Southern Agricultural Tank L stock	970,700	.....
Sinking fund accrued	176,891	156,874
Accrued expenses, taxes, interest, etc	153,964	135,105
Deferred credit	60,979	47,368
Surplus	5,263,839	5,549,728
Totals	$19,849,730	$18,256,995

Howe Sound Dividends $396,830

A report of operations of Howe Sound Co. for 1920 states that 18,161,854 lb. of copper, 101,505 oz. of silver and 6,496 oz. of gold were produced by Brittania operations. Combined profit and loss account (including Potosi Mining Co. and subsidiary operations) follows:

Debit		Credit	
Mining	$1,746,254.93	Smelter returns (copper, 18,161,854 lb.; lead, 16,041,132 lb.; silver, 2,862,976 oz.; gold, 6,496 oz.)	$6,791,066.30
Transportation (from mine ore bins to shipping terminal)	260,601.44	Miscellaneous income	233,263.84
Milling	485,265.16		
Smelting and marketing (including freight to smelter and Mexican export duty)	2,224,041.86		
Extraordinary (due to Mexican revolution, etc.)	38,411.78		
Administration (including general and legal expenses, etc.)	92,796.86		
Taxes	329,794.97		
Balance	1,847,163.14		
	$7,024,330.14		$7,024,330.14
Depreciation and depletion	$1,532,292.04		
Interest	205,117.47		
Balance	109,753.63	Balance brought down	$1,847,163.14
	$1,847,163.14		$1,847,163.14

Balance Dec. 31, 1919, was $3,220,381.38. Adding profit of $109,753.63 and deducting dividends totaling $396,830, left $2,933,305.02 on Dec. 31, 1920. Capitalization, 1,984,150 issued shares of $1 par each.

Cia. Minera "Las Dos Estrellas"

A report of operations of the Cia. Minera "Las Dos Estrellas" states that the mines and mill are near Tlalpujahua, State of Michoacán, Mexico. Financial statement follows:

		Mexican Currency—Pesos
Realized by sales of bullion		6,163,296.06
Interests		317,557.05
Income from other sources		35,282.89
		6,516,136.00
	Pesos	
Total import of operating expenses	4,952,152.19	
Depreciation in investment account	200,585.90	5,152,738.09
Net profit during 1920		1,363,397.91
Profit and loss account brought forward from 1919		449,902.70
Total profit balance at Dec. 31, 1920		1,813,300.61

Dividends during 1920 were 1,161,712.63 pesos, and the total to Dec. 31, 1920, 35,844,124.52 pesos. The import of the original capitalization, or 300,000 pesos, was returned to the shareholders during 1909, but this sum is not included in the aforementioned dividend total.

Total assets on Dec. 31, 1920, were 9,042,219.02 pesos; total liabilities, 2,026,603.38 pesos.

Development for the year amounted to 3,795 m., consisting of 1,869 m. drifting; 1,079 m. crosscutting; 727 m. raising, and 120 m. of winzes. The estimated ore reserves at the end of 1920 were 429,664 tons of proved ore and 399,535 tons of probable ore.

The total ore milled during 1920 was 361,878 dry metric tons, of an average grade of 8.9 gm. gold and 157 gm. silver per ton. The average price received for silver was $1.0064, U. S. currency, per oz. Value of metals recovered per ton of ore was 17.73 pesos. The total production of the mine from its inception (1900) down to Dec. 31, 1920, was 4,867,152 dry metric tons. The calculated net value of output to Dec. 31, 1920, is 114,426,261 pesos.

Total operating costs, including development and Mexico City office expenses, were $6.08, U. S. currency, per dry metric ton (2,204.6 lb.), compared with $5.77, U. S. currency, for the year 1919.

Mining Dividends for June, 1921

The following dividends were paid by American mining and metallurgical companies during June, 1921:

Companies in the United States	Situation	Per Share	Totals
Amer. Smelt. & Refining, pfd	U. S.	1.75 Q	$875,000.00
Calumet & Arizona Mining, c	Ariz.	0.50 Q	321,260.50
Federal Mining & Smelting, pfd., s.l	Idaho	1.00 Q	120,000.00
Golden Cycle M. & R., g	Colo.	0.02 Q	30,000.00
Hecla Mining, s.l	Idaho	0.08 Q	80,000.00
Homestake Mining, g	S. D.	0.25 M	62,790.00
Marsh Mines Consol., s.l	Idaho	0.02 I	39,500.00
National Lead	U. S.	1.50 Q	309,831.00
National Lead, pfd	U. S.	1.75 Q	426,433.00
Rochester Silver Corporation, s.g	Nev.	.05 I	88,536.75
Utah Copper Co	Utah	0.50 Q	812,245.00
Company in Mexico			
Lucky Tiger-Combination, g	Mex.	0.07 SA-X	50,073.59

Q, quarterly: I, initial; M, monthly; S.A., semi-annually; X, includes extra.

American Smelting & Refining Co. passed its dividend on common stock for the first time since 1904, and Cerro de Pasco Copper, which paid 50c. last March has passed its dividend not missed since 1916. Hecla Mining Co. announced a reduction from the 15c. paid last March, as did Utah Copper from the $1 paid at that time. The latter pays the present dividend out of the surplus earnings since 1915. Tonopah Belmont Development joins the ranks of delinquents. Marsh Mines Consolidated pays its initial dividend from the sum it received from Hecla Mining and Federated M. & S., and Rochester Silver Corporation has just effected certain settlements. Seneca Copper Corporation stockholders have authorized an additional 100,000 shares of common stock.

MINING STOCKS

Week Ended June 25, 1921

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Adventure	Boston	....	....	1/8		
Ahmeek	Boston	48	47	47	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	1/8	1/8	1/8		
Allouez	Boston	....	....	20	Mar. '19	1.00
Anaconda	New York	37 1/2	34 1/2	37 1/8	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2	2	2		
Ariz. Com'l	Boston	8	7 1/2	7 1/2	Oct. '18,	.50
Big Ledge	N. Y. Curb	1/4	1/16	1/8		
Bingham Mines	Boston	9	9	9	Sept. '19, Q	.25
Calumet & Arizona	Boston	47	45 1/2	46	June '21, Q	.50
Calumet & Hecla	Boston	235	226	229 1/2	June '20, Q	5.00
Canada Copper	N. Y. Curb	....	....	*13		
Centennial	Boston	7 1/2	7	7	Dec. '18, SA	1.00
Cerro de Pasco	New York	26	24 1/2	25	Mar. '21, Q	.50
Chile Copper	New York	10 3/8	10	10 1/8		
Chino	New York	23 1/2	20 1/8	22	Sept. '20, Q	.37 1/2
Columbus Rexall	Salt Lake	‡....	....	*26 1/2		
Con. Arizona	N. Y. Curb	....	....	1/16	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb	....	....	1/8		
Copper Range	Boston	33	32	33	Sept, '20, Q	.50
Crystal Copper (new)	Boston Curb	*36	*32	*35		
Davis-Daly	Boston	6 3/8	5 1/2	5 1/2	Mar. '20, Q	.25
East Butte	Boston	8 1/2	7 1/8	8	Dec. '19, A	.50
First National	Boston Curb	*57	*50	*52	Feb. '19, SA	.15
Franklin	Boston	2	2	2		
Gadsden Copper	N. Y. Curb	....	....	*25		
Granby Consol.	New York	18 1/2	17 1/2	17 1/2	May '19, Q	1.25
Greene-Cananea	New York	21 1/2	21	21	Nov. '20, Q	.50
Hancock	Boston	3 1/2	3 1/4	3 1/2		
Howe Sound	N. Y. Curb	....	....	2 1/2	Jan. '21, Q	.05
Inspiration Consol.	New York	32 1/2	31	32 1/8	Oct. '20, Q	1.00
Iron Cap	Boston Curb	5 1/8	4 1/2	4 3/8	Sept. '20, K	.25
Isle Royale	Boston	19 1/2	19 1/2	19 3/8	Sept. '19, SA	.50
Kennecott	New York	18 1/2	17	18 1/2	Dec. '20, Q	.50
Keweenaw	Boston	1 1/2	1 1/8	1 1/2		
Lake Copper	Boston	2 1/8	2 1/8	2 1/8		
La Salle	Boston	....	....	2		
Magma Chief	N. Y. Curb	....	....	*21		
Magma Copper	N. Y. Curb	18	17	17	Jan. '19, Q	.50
Majestic	Boston Curb	*12	*12	*12		
Mason Valley	Boston	....	....	1/8		
Mass Consolidated	Boston	2	2	2	Nov. '17, Q	1.00
Mayflower-Old Col.	Boston	3 1/8	3	3 1/8		
Miami Copper	New York	20 1/2	19	20 1/2	May '21, Q	.50
Michigan	Boston	....	....	2		
Mohawk	Boston	48 1/2	47	47 1/2	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb	5	4 1/2	5		
Nevada Consol.	New York	11 1/4	9 1/2	11 1/4	Sept. '20, Q	.25
New Baltic	Boston Curb	....	....	3		
New Cornelia	Boston	14 1/4	14	14 1/2	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb	....	....	*5		
North Butte	Boston	9 1/2	8 1/2	8 3/4	Oct. '18, Q	.25
North Lake	Boston	....	....	1/8		
Ohio Copper	N. Y. Curb	....	....	1/16		
Old Dominion	Boston	19 1/2	19	19	Dec. '18, Q	1.00
Osceola	Boston	26	25	26	June '20, Q	.50
Phelps Dodge	Open Mar.	†160	†150	....	Apr. '21, Q	1.00
Quincy	Boston	37	36 1/2	36 3/4	Mar. '20, Q	1.00
Ray Consolidated	New York	12 3/8	12	12 1/2	Dec. '20, Q	.25
Ray Hercules	Boston Curb	*30	*24	*24		
St. Mary's Min. Ld.	Boston	33	31	33	June '20, K	2.00
Seneca Copper	Boston	14 1/4	14	14		
Shannon	Boston	*90	*80	*90	Nov. '17, Q	.25
Shattuck Arizona	New York	6 1/2	6 1/8	6 1/8	Jan. '20, Q	.25
South Lake	Boston	....	....	1		
Superior Copper	Boston	....	....	3 1/8	Apr. '17,	1.00
Superior & Boston	Boston	1 1/8	1	1 1/16		
Tenn. C. & C. cfs	New York	7 1/8	7	7 1/8	May '18, I	1.00
Toulumne	Boston	*60	*50	*60	May '13,	.10
United Verde Ex.	Boston Curb	23	21	22	May '21, Q	.25
Utah Consol.	Boston	4	3 1/8	3 1/8	Sept. '18,	.25
Utah Copper	New York	50	45 1/2	48 1/8	June '21, Q	.50
Utah Metal & T.	Boston	1 1/16	1 1/8	1 1/8	Dec. '17,	.30
Victoria	Boston	1 1/8	1 1/8	1 1/8		
Winona	Boston	*40	*40	*40		
Wolverine	Boston	10 1/2	9	9		
NICKEL-COPPER						
Internat. Nickel	New York	14 1/4	13	13 1/2	Mar. '19,	.50
Internat. Nickel, pf.	New York	....	....	82 1/2	May '21, Q	1.50
LEAD						
National Lead	New York	72	69	71 1/4	Mar. '21, Q	1.50
National Lead, pfd.	New York	100 1/2	100	100 1/2	June '21, Q	1.75
St. Joseph Lead	New York	11	10 1/8	11	June '21, Q	.25
Stewart Mining	Boston Curb	....	....	*6	Dec. '15,	.05
ZINC						
Am. Z. L. & S.	New York	8 1/8	7 1/8	8 1/8	May '20,	1.00
Am. Z. L. & S. pfd.	New York	25 1/2	23 1/2	24	Nov. '20, Q	1.50
Butte C. & Z.	New York	4 1/2	4	4	June '18,	.50
Butte & Superior	New York	11 1/8	10 1/2	10 3/8	Sept. '20,	1.25
Callahan Zn-Ld.	New York	4 1/8	4 1/4	4 1/8	Dec. '20, Q	.50
New Jersey Zn.	N. Y. Curb	120	117	120	May '21, Q	2.00
Success	N. Y. Curb	*3	*1 1/2	*2 1/2	July '16,	.03
Yellow Pine	Los Angeles	....	....	*55	Sept. '20, Q	.03

* Cents per share. † Bid or asked. ‡Quotations missing. Q, Quarterly. SA, Semi-annualy. BM, Bi-monthly. K, Irregular. I, Initial. X, Includes extra.

Stock	Exch.	High	Low	Last		Last Div.
GOLD						
Alaska Gold	New York	1/8	1/8	1/8		
Alaska Juneau	New York	1 1/2	1 1/2	1 1/2		
Carson Hill	N. Y. Curb	....	....	13 1/2		
Cresson Consol. G.	N. Y. Curb	1 1/2	1 1/2	1 1/2	June '20, Q	$0.10
Dome Extension	Toronto	....	....	*75		
Dome Mines	New York	17 1/2	14 1/2	16 1/2	Apr. '21, Q	.25
Golden Cycle	Colo. Springs	*70	*70	*70	June '21, Q	.02
Goldfield Consol.	N. Y. Curb	*7	*6 1/2	*7	Dec. '19,	.05
Hollinger Consol.	Toronto	7.20	7.08	7.19	Feb. '21, M	.05
Homestake Mining	New York	55	54 1/2	55	June '21, M	.25
Kirkland Lake	Toronto	*43	*40	*40		
Lake Shore	Toronto	1.30	1.13	1.13	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	1.90	1.85	1.85	Jan. '21, K	.05
Porcupine Crown	Toronto	*16 1/2	*13	*13	July '17,	.03
Portland	Colo. Springs	....	....	*59 1/2	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	*4 1/2	*3	*4	May '19,	.05
Silver Pick	N. Y. Curb	*10	*6	*8		
Teck Hughes	Toronto	*12	*11 1/2	12		
Tom Reed	Los Angeles	*76 1/2	*68	*69 1/2	Dec. '19,	.02
United Eastern	N. Y. Curb	2 3/16	2 1/16	2 1/8	Apr. '21, Q	.15
Vindicator Consol.	Colo. Springs	....	....	*37 1/2	Jan. '20, Q	.01
West Dome Consol.	Toronto	*6 1/2	*6	*6 1/2		
White Caps Mining	N. Y. Curb	*7	*5	*6		
Yukon Gold	N. Y. Curb	1 1/8	1	1 1/8	June '18,	.02 1/2
SILVER						
Arizona Silver	Boston Curb	*20	*16	*20	Apr. '20, M	.03
Batopilas Mining	New York	1/8	1/8	1/8	Dec. '07, I	.12 1/2
Beaver Consol.	Toronto	....	....	*30	May '20, K	.03
Coniagas	Toronto	....	....	1.70	May '21, Q	.12 1/2
Crown Reserve	Toronto	*9 1/2	*9 1/2	*9 1/2	Jan. '17,	.05
Kerr Lake	Boston	2 1/8	2 1/8	2 1/8	Apr. '21, Q	.12 1/2
La Rose	Toronto	....	....	*20	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	....	....	*20	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.15	1.11	1.11	Sept. '20, Q	.12 1/2
Nipissing	N. Y. Curb	4 1/2	4 1/2	4 1/2	Apr. '21, Q	.15
Ontario Silver	New York	4	4	4	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	....	....	2	Jan. '12,	.10
Peterson Lake	Toronto	....	....	*5	Jan. '17,	.01 1/2
Temiskaming	Toronto	*21	*21	*21	Jan. '20, K	.04
Trethewey	Toronto	*16 1/2	*15	*15 1/2	Jan. '19,	.05
GOLD AND SILVER						
Atlanta	N. Y. Curb	*1	*1	*1		
Barnes-King	Butte	‡....	....	1.10	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*55	*44	*52		
Cashboy	N. Y. Curb	*5	*4	*5		
El Salvador	N. Y. Curb	....	....	1/8		
Jim Butler	N. Y. Curb	*9	*7 1/2	*8 1/2	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*6	*4	*5	June '16,	.05
Louisiana Con.	N. Y. Curb	....	....	1/8		
MacNamara M.& M.	N. Y. Curb	*15	*15	*15	May '10,	.02 1/2
N. Y. Hond. Rosar.	Open Mar.	†10 1/2	†9	....	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1 1/8	1	1 1/8	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	1 1/8	1	1 1/16		
Tonopah-Extension	N. Y. Curb	1 1/16	1 1/16	1 1/16	Apr. '21, Q	.05
Tonopah Mining	N. Y. Curb	1 1/8	1 1/8	1 1/16	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	1/8	1/8	1/8	Dec. '19, SA	.05
SILVER-LEAD						
Caledonia	N. Y. Curb	*10	*9	*9 1/2	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	‡....	....	1.10	Dec. '21,	.15
Chief Consol.	Boston Curb	2 1/2	2 1/2	2 1/2	May '21, Q	.05
Consol. M. & S.	Montreal	15	12 1/2	12 1/2	Oct. '20, Q	.62 1/2
Daly Mining	Salt Lake	‡....	....	1.50	July '20, Q	.10
Daly-West	Bostor	....	....	2 1/2	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	....	....	2	Apr. '21, K	.05
Electric Point	Spokane	....	....	*7	May '20, SA	.03
Federal M. & S.	New York	5 1/2	5 1/2	5 1/2	Jan. '09,	1.50
Federal M. & S., pfd	New York	22 1/2	21 1/2	21 1/2	June '21, Q	1.00
Florence Silver	Spokane	....	....	*12 1/2	Apr. '19,	.01 1/2
Grand Central	Salt Lake	‡....	....	*07 1/2	June '20, K	.03
Hecla Mining	N. Y. Curb	4	3 1/2	3 1/2	June '21, Q	.08
Iron Blossom	N. Y. Curb	1/16	1/16	1/16	Apr. '20, Q	.02 1/2
Judge M. & S.	Salt Lake	‡....	....	3.00	Sept. '20, Q	.12 1/2
Marsh Mines	N. Y. Curb	*5	*4	*5	June '21, I	.02
Prince Consol.	N. Y. Curb	1/8	1/16	1/16	Nov. '17,	.02 1/2
Rambler-Cariboo	Spokane	*4	*4	*4	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*7 1/2	*7	*7 1/2		
South Hecla	Salt Lake	‡....	....	*53	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	1/16	1/8	1/8	Oct. '17,	.05
Tamarack-Custer	Spokane	1.85	1.80	1.80	Jan. '21, K	.04
Tintic Standard	Salt Lake	‡....	....	2.40	June '20, Q	.10
Utah Apex	Boston	2 1/8	2	2	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	3	2	3	Nov. '17,	.01
QUICKSILVER						
New Idria	Boston	†*50	†....	*50	Jan. '19,	.25
VANADIUM						
Vanadium Corp.	New York	28 1/2	25 1/2	28	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	55	39 1/2	46	Apr. '21, Q	1.50
Asbestos Corp., pfd.	Montreal	....	....	78	Apr. '21, Q	1.75
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref.	New York	36 1/2	32 1/8	35 1/8	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf	New York	70	67	68 1/2	June '21, Q	1.75
Am. Sm. pf. A	New York	70	69	69	Apr. '21, Q	1.50
U. S. Sm. R. & M.	New York	29 1/2	29	29	Jan. '21, Q	.50
U.S.Sm.R.& M. pf.	Boston	40 1/2	39 1/2	39 1/2	Apr. '21, Q	.87 1/2